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Where is He?

THE electrical industry is, or should be, searching for a man—a man for a very special piece of work—work to be done during a very important period.

Only two men in Britain have ever been called upon to fill the post, and both have been successes. The ELECTRICAL REVIEW would be the last to withhold from them the gratitude that we all owe them for what they have accomplished. But they were appointed when the needs differed from those of to-day. To one fell the originating duty of the pioneer; he had to be a man of ideas, a man who knew what the times needed, who believed profoundly in the task to which he pledged himself, yet possessed in full measure a tactful and accommodating spirit without which nobody could secure the co-operation of manifold different interests. And that co-operation was the most vital thing in laying foundations essential to the upbuilding of a great organisation. The industry will always remember that it was JOSEPH WILLIAM BEAUCHAMP, who with great good humour and with a confidence that beat down many disheartening obstacles, performed that pioneering part. To the other, LT.-COL. W. A. VIGNOLES, who, concurrently with Beauchamp, had long had the interests of the organisation very near his heart, it fell to follow as his successor in the directorship. Though in office for a much briefer period, he has consolidated its work in many places, maintaining, and still further adding to, the efficiency of the movement, in his unobtrusive and quietly effective way. This is where we stand, then, toward the end of 1930; we have had the benefit of two excellent Directors, their genius and their wide knowledge of the electrical industry, and they have built up, so far as detailed working is concerned, an Electrical Development Association manned by a staff which knows its work so far as the Industry has enabled it to plan it. And now that Vignoles is going—what is to be done? What ought the Industry to do?—for after all it is an appointment made by and paid for by the Industry.

Primarily the question of a successor is one for the

Executive Council, but it is also one in which all departments of the industry should be very closely interested. Why not take a bold plunge with the strong resolution that in Faraday Centenary Year the whole nation shall be made to feel the direct influence of one great big impressive electrical boost? And why not bring the collective mind of the whole industry upon the responsible duty of finding a real live man to carry us through such a period? Avoid the dangerous disposition to limit him in salary to already accepted standards. Find the man, never mind the salary! The right man if he can be found—and we believe he can somewhere—will earn his salary over and over again in the return he will bring to the industry. Perhaps even some of the large financial interests at present holding aloof might throw over their apathy if there were a real booming of the British electrical guns. Don't let us tie the new man down to too much detail duty—others can do that. Let him be free to give an enthusiastic leading. There is room for such a man. He can make a great name for himself the while he brings the industry that atmosphere which now seems sometimes to be lacking.

Of all that is being done in many parts of the land we are proud. Here a little, there a little, at long last closes up the vacant places—in time, but how much time? It is slow, far too slow—when we know that electricity is so good a thing that everybody ought to be using it directly it is available.

We have no man in mind for this job, but among the host of our readers everybody knows someone of outstanding ability. We have, of course, no desire to hamper or handicap the authorities in any way, but there may be a Saul amongst us, head and shoulders taller than his fellows, ready for anointing—a man of wide knowledge of the trade and its co-operative problems, a man of strength, perhaps of striking personality, with some gift of persuasive public speech and a great flood of contagious enthusiasm. Can we together help the Executive to find such a man? Brought to the fore at this particular juncture, with a free hand to give a popular lead, he might make the Electrical Industry his debtor for long years to come. Let us all put on our thinking caps.

Road Transport.

It is evident from the discussions which took place at the Conference of the Municipal Tramways and Transport Association, and were reported by us last week, that the tramcar still has its strong advocates. It is necessary, however, to recognise the fact that the past few years have witnessed the passing of the tramcar as the only important popular conveyance in urban areas and also to consider what part electricity can still play in the evolutionary progress. In a pronouncement regarding co-ordination of London traffic reported in this issue, the Minister of Transport lays down that the type of vehicle employed should be dictated by technical and commercial considerations in the interests of the travelling public—a principle that will meet with general acceptance.

The chief cause of the twilight of the electrically propelled railed vehicle is, of course, the development of the internal-combustion engine, which appears to meet with more public favour than its old rival, and has in many cases distinct advantages. The reasons for these advantages need to be carefully analysed, if the impetus given by them is not to degenerate into a "fashion" which may sweep away good and bad, alike, in the old *régime*.

In many areas the cost of track renewals has become prohibitive, particularly for systems depending on many loops and passing places, as the president of the Association, Alderman Thos. Canby, pointed out. This is chiefly the case in small towns, which installed tramways at a time when there was no practicable alternative.

Criticism of tramcars is often based upon comparisons between rolling stock perhaps 20 years old and new petrol 'buses. It is not always remembered that tramcars have a much longer life and that their working costs include the expensive fulfilment of many statutory obligations which 'buses are not required to face, such as the maintenance of the track (including a space of 18 inches on each side of it) and the payment of rates on gross earnings. There is now far more wear and tear of the track, due to all manner of vehicles, and abandonment of the tramways would involve these charges falling on the ratepayers through other channels. These considerations, and many others, were set out in the paper by Councillor A. H. Gledhill.

It would appear to us that the case for the retention of the tramways in large urban areas has been made out, subject to improvements in schedule speed and passenger comfort. Where the rail system is clearly unsuited for present-day needs, the trolley-'bus has much in its favour, as compared with the petrol 'bus, *e.g.*, lower maintenance costs, smoother running due to absence of gears, better acceleration, and the avoidance of noise and smell. In spite of these advantages there are situations in which overhead trolley wires are inadmissible, and there it may be possible to make capital out of the important developments that have taken place recently in the application of the heavy-oil engine to traction.

In his paper on the subject Mr. W. Vane Morland shows the very substantial fuel economy obtained by the use of these engines, but points out that they are not sufficiently refined for operation for urban traffic. This defect could surely be obviated by the use of electric gearing. The petrol-electric drive failed to make the headway that some people at one time expected, but that was because the fine qualities of the modern petrol engine created general satisfaction with its performance. The heavy-oil engine is at present, and may be for many years, devoid of these qualities, but it has others of its own. In addition to the advantage of a lower fuel cost (about one-sixth of that of the petrol-engine which, Mr. Morland computes, would amount to more than £200 per annum for each double-deck omnibus) and reduction of fire risk, the fuel itself is a home-product, which could be produced by gas works, coke-ovens, and low-temperature carbonisation plant.

We suggest that, rather than risk discrediting a very promising engineering development by premature action, or, alternatively, rather than wait, perhaps very many years, for its full employment, the feasibility of developing the heavy-oil engined 'bus, in conjunction with the electric drive, is worthy of immediate consideration by the various interests concerned.

Starting D.C. Motors.

In the article on "D.C. Motor Startors," contributed by Professor David Robertson, two side issues are raised, both relating to standardisation.

The first is the question whether, in the light of Professor Robertson's calculations, the common use of a relatively expensive shunt-motor starting switch with a machine having a series field is justified.

The second side-issue is the use of the word "startor." This spelling is, of course, in line with the use of the termination "—or" in the B.E.S.A. Glossary to indicate apparatus as distinct from persons, but it would, in our opinion, have been better if the same concession to popular usage had been made as in the case of other well-established words, such as "balancer."

Our Special Issue.

Next week's edition of the Electrical Review will be our fifth Special Autumn Issue. It will be greatly enlarged, and once again, as last year, we shall extend its scope beyond the Domestic field so as to include many illustrated articles relating to certain departments of electrical power and industrial development. We feel justified by the past reception given to our annual issues in believing that it will be awaited by readers, both trade and technical, with expectancy, and that it will be a "Review" for the trader to keep close at hand during the season.

The E.M.V. "Cementkarrier."

Descriptive details of an uncommon type of Diesel-electrically propelled ship which is equipped with electrically-driven pumps and blowers for self-discharging her cement cargo.

BEARING a name that is indicative of the cargo she was specially designed to carry in bulk, the E.M.V. *Cementkarrier* (fig. 1) was built by the Furness Shipbuilding Co., Ltd., Haverton Hill-on-Tees, for the Canada Cement Transport Co., Ltd., of Montreal, under the superintendence of her designer, Mr. W. F. Fletcher, consulting engineer, of Montreal, his resident surveyor being Mr. Thos. Jones.

Her particular features of interest are the Diesel-electric propelling machinery* and the electric cement pump-discharging gear, in which respects she is the first electrical self-discharging vessel to be laid down in this country. The Furness Co. specialises in ships designed for self-discharging cargo in bulk.

The electrical propelling machinery was made at the Witton works of the General Electric Co., Ltd., which was also responsible for the manufacture of the main switchboard and the majority of the auxiliary electrical equipment of the boat, including engine-room auxiliary drives, air-compressor motors and control gear, cables, signalling and telephone equipment, cabin-ventilating fans, and many types of lighting fittings, containing "Osram" lamps, the deck being flood-lighted fore and aft.

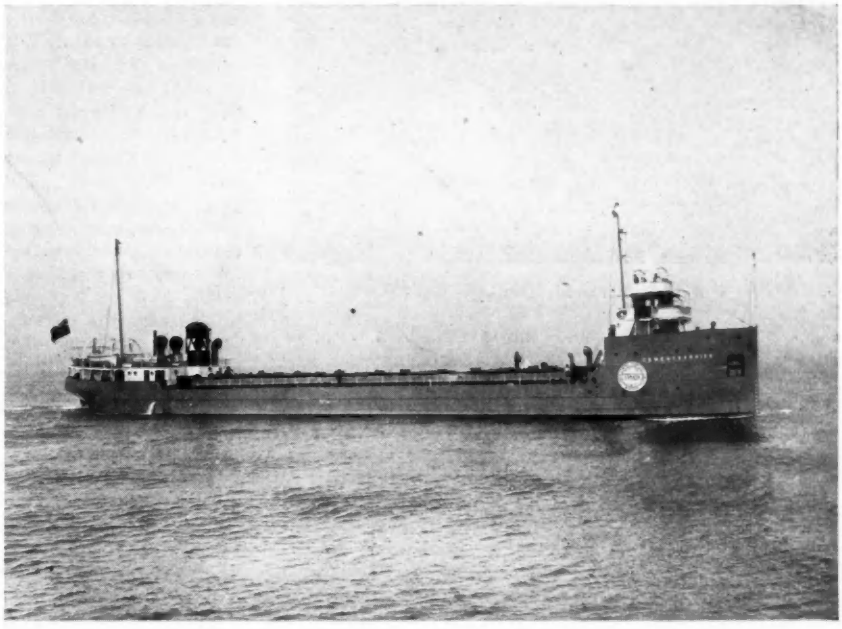


Fig. 1.—The E.M.V. "Cementkarrier."

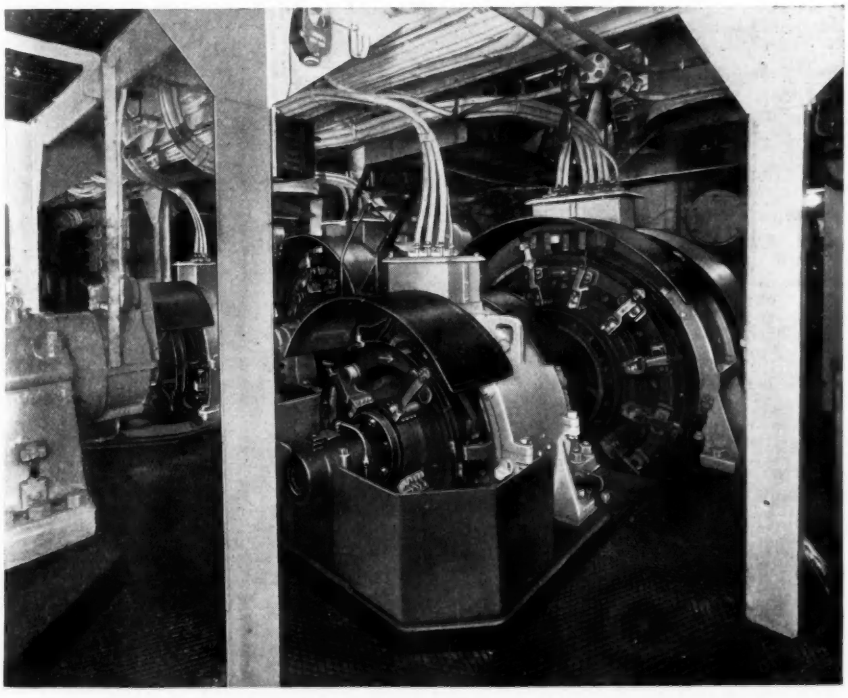


Fig. 2.—Main 360-kW and Auxiliary 50-kW Generators.

The ship's principal dimensions are: length 258 ft., beam 43 ft. 2 in., and moulded depth 20 ft.; a total dead weight of about 3,150 tons will be carried on the load draft. The vessel conforms to the limiting conditions imposed by the Canadian canal locks for service on the Great Lakes, St. Lawrence River, and coastal trade. The owner's private suite is tastefully decorated, and comfortable accommodation has been provided for the crew, which includes a chief engineer, chief electrician, engineers, and electricians, besides other ratings. Steam heating meets the severe Canadian conditions, and the culinary quarters include a cold store in which is an electrically-driven refrigerator.

The cement cargo is delivered to the ship through shore pipes, which discharge through small watertight steel access hatches on the trunk top into three self-trimming holds of hopper formation, each arranged to

* See Elec. Rev., Sept. 26th, 1930, p. 489.

deliver the cargo into two fore and aft scraper tunnels.

The discharging gear consists essentially of a Sauerman scraper of 4 cu. yd. capacity (fig. 4) in each tunnel, supported from a traveller running on an overhead trackway, and hauled (fig. 3) along the tunnels by steel wires up an inclined path, which discharge the cement into a hopper bunker. The latter in turn

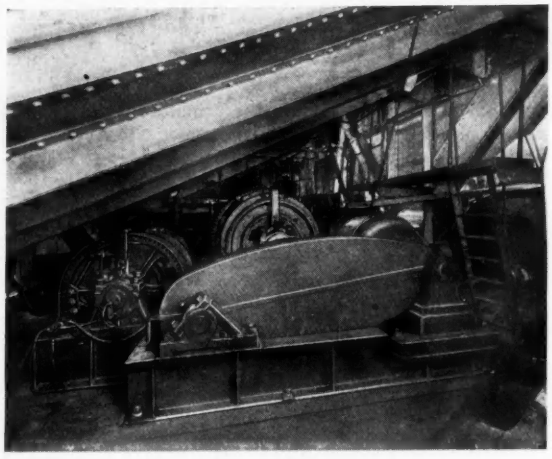


Fig. 3.—Scraper Haulage Gear.

feeds through a sliding gate the archimedean screw of an electrically-driven high-speed Fuller-Kenyon cement pump (fig. 5). The cement is then blown overboard through an 8-in. discharge pipe-line by two Reavell air compressors, each electrically driven by a 208-h.p. "Witton" motor. This machinery is fitted in a separate compartment at the fore end of the vessel.

The special mooring arrangements required on all Canadian canal vessels have received particular attention, and four electric warping winches made by the Sunderland Forge Co. have been fitted, together with an Emerson-Walker electric windlass (fig. 7) and an electric snubbing winch with wire compressor, all the motors being fed at 220 volts. All-electric Donkin-Scott steering gear is electrically operated from the wheelhouse, the steering motor being sensitively controlled by a motor-generator and two self-balancing field resistances.

The vessel is Diesel-electrically propelled, the two main G.E.C. generators being driven by "Polar" engines supplied by the Atlas Co., of Stockholm. They are rated at 500 h.p. each when running at 220 r.p.m., and are of the 2-cycle airless injection type with four cylinders of "monobloc" construction, 340 mm. bore by 570 mm. stroke. The fuel consumption is only 0.375 lb. per b.h.p.-hour at both full and three-quarter loads; even at half load it does not exceed 0.385 lb. per b.h.p.-hour. They are, therefore, efficient under varying-load conditions.

In order to shorten the overall length the flywheels are mounted on the generator coupling flanges, and each engine is fitted with a directly-driven water-circulating pump. Starting air is provided by a motor-driven auxiliary compressor; for emergency use a similar compressor is driven by a "Polar" 6-b.h.p. crude-oil engine, which is easily started by hand.

Each engine drives one of the main 360-kW, 440-volt, d.c. generators (fig. 2), and coupled to each shaft is a 50-kW, 220-volt, compound-wound generator for supplying the auxiliary load (which consists chiefly of engine-room auxiliaries), excitation circuits, and lighting. The main generators, when supplying the propulsion motor, run as shunt-wound machines connected in series. The propeller motor is of the double-armature type rated at 775 h.p., the midpoint being earthed when in service, so that there is 440 volts to the ship's frame. It is directly-coupled to the propeller shaft and runs at speeds up to approximately 100 r.p.m. The output required from each main generator for the propeller motor on full load is 320 kW, the balance of power from each engine being utilised for the 50-kW auxiliary generators, which run in parallel and have Brown-Boveri automatic voltage regulators to maintain constant voltage when the engine speed fluctuates due to sudden variation in propulsion load when manœuvring. In addition, two 30-kW, 220-volt, emergency sets, consisting of Petter "Atomic" Diesel engines driving compound-wound "Witton" generators may also be run in parallel with the auxiliary generators.

When the ship is in port the main generators run as compound-wound machines in parallel to supply the cargo-handling machinery, which is driven on the Ward-Leonard principle, the generator fields being controlled by motor-driven field regulators.

Four control positions are provided: (i) in the wheelhouse on bridge, (ii) on the flying bridge, and (iii) in the engine room are pillars exactly similar to ship's standard bridge telegraphs. The first and second are mechanically coupled, but in case of necessity, such as a breakdown in the cabling, the engineer can take control at the third pillar by throwing over a switch which automatically cuts out the bridge control, the engineer then taking his orders by standard telegraph or telephone from the bridge. Should the electric control become inoperative, the engineer can, in an emergency, open a door in the regulator itself, exposing (iv) a handwheel for manual operation, the action of opening the door automatically making the change-over. A system of visual and audible signals is provided between the bridge and the engine room to indicate when control is transferred from one to the other, and the navigating officer, or the engineer, as the case may be, must acknowledge those signals by operating a switch which cuts out the warning devices in both positions. The bridge pillar controls the regulator-driving motor through the medium of a specially-developed relay, and follow-up gear compels the regulator so to move that the propeller speed corresponds with the position of the bridge pillar indicator. The design of the equipment is such that only three small cables are required between the bridge and the engine room, while the bridge con-

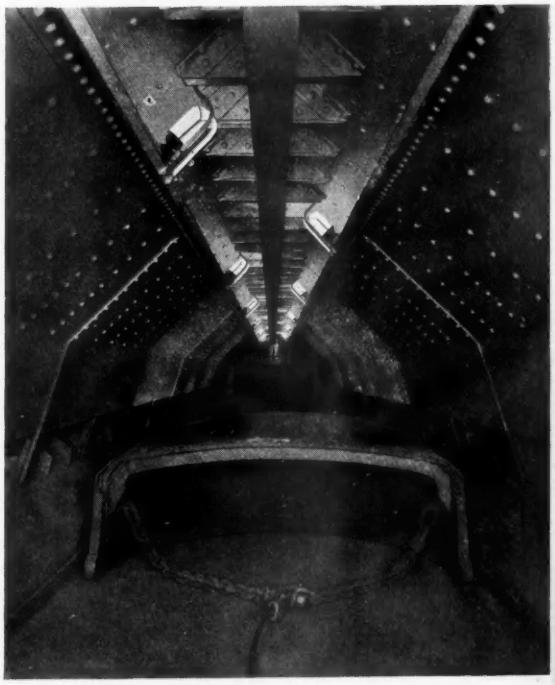


Fig. 4.—Cement Cargo Scraper.

troller can be moved rapidly to any position without danger, as the maximum speed of the regulator is limited by the speed of its driving motor, and should there be any excessive load the over-power or reverse-power relays will interrupt the driving-motor circuit until the power returns to its normal value.

The generator fields are energised from special 220-

volt auxiliary bus-bars connected through an automatic change-over contactor to the main 220-volt bars, which derive their supply from the 50-kW generators. To the special auxiliary bus-bars are also connected emergency circuits for the steering gear, navigation lights, &c. Should the main 220-volt supply fail, the automatic contactor will switch the auxiliary bus-bars on to emergency battery discharge bus-bars. The capacity of the emergency battery is 120 ampere-hours at 220 volts, and it is of the " Dri-Power " type manufactured by the Young Accumulator Co. Supply can thus be maintained until the emergency generator can be started, when the contactors will switch the auxiliary bus-bars back to the main circuit.

In order to provide ample flexibility and alternative connections for emergency running, change-over-type selector switches are provided for each half of the motor and for the generators (fig. 6) of the make-before-break type, with special sequence catches and auxiliary contacts. The sequence catches hold up the movement of the change-over switches immediately after the opening of the auxiliary contacts, which control the operating circuits of the corresponding field contactors. This hold-up of movement allows sufficient time for the field flux to die down before the change-over switch temporarily short circuits the armature, thus preventing heavy currents due to such short circuiting. The final movement of the selector switch isolates the armature from the circuit, and the removal of any machine can thus be carried out without shutting down.

The field contactors of the various machines are provided with auxiliary contacts which, when open, automatically insert suitable resistances in either the motor or generator field circuits in order to adjust the operating conditions to the new combination of machines left in circuit. This procedure, in conjunction with special balancing relays, forms the subject of a patent, and enables propulsion to continue without shutting down when the number of machines in circuit is altered either deliberately by hand or by emergency through machine failure. The operation of the change-over selector switches is also arranged to

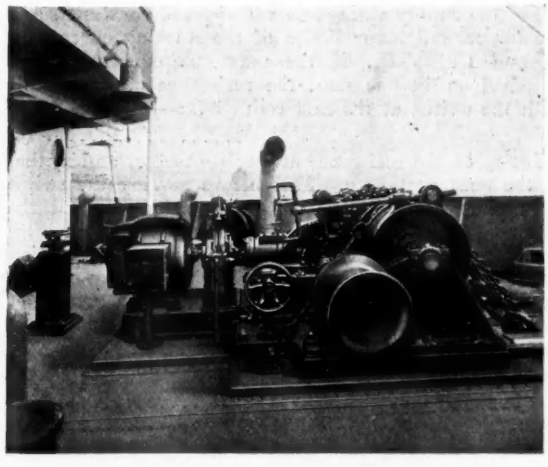


Fig. 7.—Motor-driven Windlass.

indicate on the bridge, by means of auxiliary contacts and pilot lamps, exactly which machines are in service for propulsion purposes.

The automatic removal of a machine which fails is provided for by the use of two special balancing relays, one being used for the two generators and another for

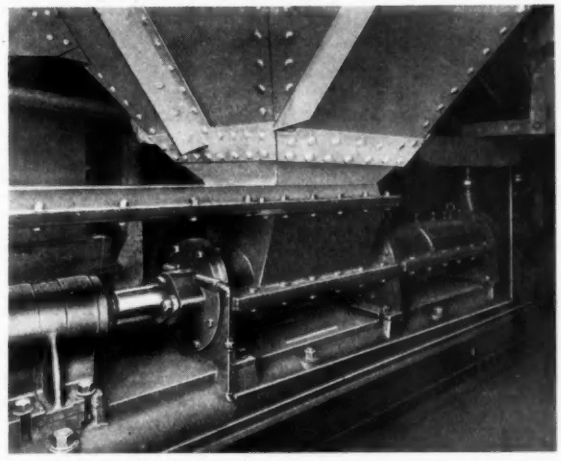


Fig. 5.—Cement Discharge Pump.

the two halves of the motor. Under normal conditions the two generators should be giving voltage equal in value and direction at any time during the propulsion service, whether at low or high value, or for ahead or reverse running. Similarly, the voltage drop across the motor armatures should be equal in value and direction. Should a machine fail, the voltages of the two generators, or of the two halves of the motor, would become different in value and cause the balancing relays to operate to one side or the other, so opening field contactors of the faulty machine and, as described above, automatically inserting resistance in the various field circuits to adjust them to a suitable value for the new operating conditions.

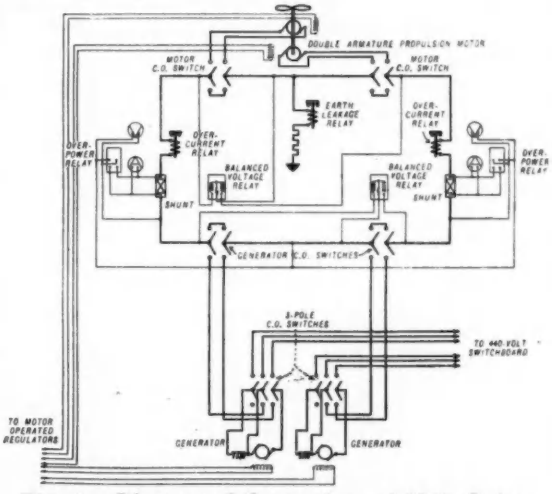


Fig. 6.—Diagram of Connections of Main Drive.

The overload relays in the main circuit are provided with short time-delays to give the balancing relays time to deal with faults which are not a permanent leakage to earth. Earth leakage faults operate a relay and cut off all excitation. Persistent overloads that are not cleared by the balance relays, or the earth leakage, would also shut off the whole of the excitation. After the balancing relays have opened the field of a faulty machine, the engineer can, so soon as is convenient, throw over the corresponding selector switch and isolate the armature of the faulty machine without interrupting the supply.

The main switchboard consists of 14 panels, and there are, in addition, two selector panels and a main circuit-breaker panel for controlling supply to the forward 440-volt switchboard that has two panels which control, respectively, the 300-h.p. cement discharge pump and the two 100-h.p. scrapers.

The auxiliary pumps are of Messrs. Drysdale & Co.'s manufacture, all electrically driven by " Witton " motors and controlled by G.E.C. marine drum-type, or counter e.m.f. starters. The two oil purifiers installed were manufactured by British Separators, Ltd.

The fans for cooling the main motor and for ventilating the engine room are of the Davidson "Sirocco " type controlled by contactor starting panels. The Reavell compressors are also operated from contactor panels.

D.C. Motor Startors*.

Basic considerations governing the proportioning of resistance steps for starting shunt-wound and series-wound motors.

By PROFESSOR DAVID ROBERTSON.

EVERY student knows that it is generally necessary to insert resistance in series with the armature of a d.c. motor during the starting period in order to restrict the current taken, but often he is acquainted with one only of the several reasons for that restriction, and his one reason is the least important of all.

The maximum current permissible is limited by the following considerations:—

(1) Interference with other users of the same supply by voltage disturbances.

(2) Harmful sparking at the brushes of the motor.

(3) Maximum torque permitted by the strength of the motor, load, and coupling, or by the maximum acceleration allowable with the particular load driven.

(4) Heating of the motor.

It will depend upon the circumstances which of these factors determines the actual limit. The supply restrictions generally take the form of a limit to the *steps* of current; with a very large motor they may require the initial current to be applied in two or more steps instead of all at once, and this will need more resistance in the rheostat than would otherwise be necessary.

No. (2) will depend on the quality of the motor; a modern motor with commutating poles should give a limit well over twice full-load current.

The motor itself should be strong enough mechanically to stand short-circuiting across the mains, at least until the fuse blows, but the machine driven may not have sufficient strength for this. Moreover, it may be desirable to restrict the acceleration for reasons other than mechanical breakdown. For instance, if the motor be driving a tramcar, we must take into account the comfort of the passengers and the possibility of skidding the wheels, as well as the strength of the car structure.

The heating of the motor by the starting current is seldom of importance, except with very frequent starting, because of the short time for which the excessive currents last, but if large starting currents are to be used it is just as well to make certain that the pigtails of the brushes have ample section.

The ideal method of starting would be to switch on a current of the maximum value permitted, and to keep it constant by cutting out resistance as the motor gets up speed until all the added resistance is removed. This would give the smoothest and quickest start, with the minimum waste of energy and least generation of heat in the rheostats.

Except, perhaps, at the end of the process, a good approximation to this ideal can be obtained with a liquid rheostat with its gradual change of resistance, but, except for very large machines, a metallic rheostat is more satisfactory, and it must be reduced in steps. With the face-plate type of switch the number of contacts does not greatly affect the cost so long as it does not require a bigger slate, but with contactor types it is necessary to do with a minimum number of steps, because of the cost of the contactors.

With metallic rheostats we switch on the maximum current and wait on the first contact until it falls to some lower limit; we then cut out sufficient of the rheostat to bring the current up to the maximum once more, and so on until the last contact, when the rheostat is entirely cut out of circuit.

As a rule the lower limit is taken as full-load current; this is usually sufficient, since most loads give a smaller resisting torque at the lower speeds than at full speed. The accelerating torque is equal to the excess of the motor torque over the load torque, and becomes small as these approach one another. With some kinds of load the resisting torque is nearly constant at all speeds, with the result that the acceleration becomes very small as the current approaches full load value. If we wait on each step until that value is reached, the whole starting process becomes too slow. With such loads it is therefore desirable to set the lower limit of starting current at somewhat more than full load current.

Main Circuit of Machine.

Fig. 1 shows the main circuit of the machine, the resistance being R_1 on the first contact and R_m on the mth or last of the m contacts. R_m is the total resistance left in the main circuit when the startor is in the full on position; it includes the armature, brushes, commutating pole coils, if any, series field coils, if any, and cables, as well as the overload coil, switch, and internal connections of the startor. For brevity we shall refer to it as the "machine resistance."

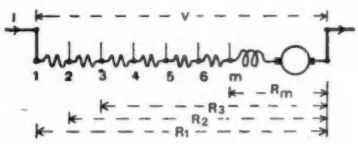


Fig. 1.—Main Circuit of Machine.

Let the supply voltage be v (supposed constant), and the upper and lower limits of the starting current be I_U and I_L. Then, if the maximum current may be switched on in one step, the resistance of the circuit with the switch at the first contact is:—

$$R_1 = V/I_U \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (1)$$

Let R_x be the resistance at any contact x, and R_y that at the next contact y. Just before moving the switch the motion e.m.f. has risen to the value E_x and the current fallen to the lower limit I_L; immediately after the current rises to the upper limit I_U and the motion e.m.f. becomes E_y. We shall neglect inductance e.m.f.'s and suppose that the time constant for the growth of the current is small enough to permit us to neglect changes in speed whilst the current is growing.

Then, just before moving switch, $V = R_x I_L + E_x$ ..... (2)

and just after doing so, $V = R_y I_U + E_y$ ..... (3)

Hence, $R_y = R_x(I_L/I_U) - (E_y - F_x)/I_U$ ..... (4)

With a shunt-wound motor E_x and E_y are practically alike and we get the well-known simple relationship between R_y and R_x, but with series-wound, or compound-wound, machines E_y will be greater than E_x because the flux must increase along with the armature current. It is thus evident that with the latter machines the rheostat may be cut out in bigger steps than with a

* The spelling of this word is recommended in the "British Standard Glossary of Terms used in Electrical Engineering" issued by the British Engineering Standards Association.

shunt motor that is started with the same limits of current.

With a differentially-wound compound motor the reverse would be true, but such motors are always started as shunt machines by cutting out the series coils until the machine is up to speed. In this way a greater torque is obtained during starting than would otherwise be given, and at the same time we avoid all risk of the magnets being reversed by the large series current, and thereby making the machine start running in the wrong direction.

Startor for Shunt Motor.

With a shunt motor the flux is constant after the first two or three seconds, and consequently $E_y = E_x$, as we are supposing that there is no appreciable speed change before the current reaches its full value. Equation 4 then becomes:—

$$R_y = R_x(I_L/I_U) \quad \ldots\ldots\ldots\ldots\ldots\ldots (5)$$

Applying this equation in turn to the successive contacts, we get:—

$$R_3 = R_1(I_L/I_U) \quad \ldots\ldots\ldots\ldots\ldots\ldots (6)$$

$$R_2 = R_2(I_L/I_U) \quad \ldots\ldots\ldots\ldots\ldots\ldots (7)$$

$$R_m = R_{m-1}(I_L/I_U) \quad \ldots\ldots\ldots\ldots\ldots\ldots (8)$$

Multiplying these equations together, the R's disappear, except R_1 and R_m, with the result that:—

$$(I_U/I_L)^{m-1} = R_1/R_m \quad \ldots\ldots\ldots\ldots\ldots\ldots (9)$$

$$(I_U/I_L)^m = R_1 I_U/R_m I_L = V/R_m I_L \quad \ldots\ldots\ldots\ldots\ldots\ldots (10)$$

$$I_U/I_L = (V/R_m I_L)^{1/m} = (R_1/R_m)^{1/(m-1)} \quad \ldots\ldots\ldots (11)$$

or, $$m = (\log V - \log R_m I_L) \div (\log I_U - \log I_L) \quad \ldots\ldots (12)$$

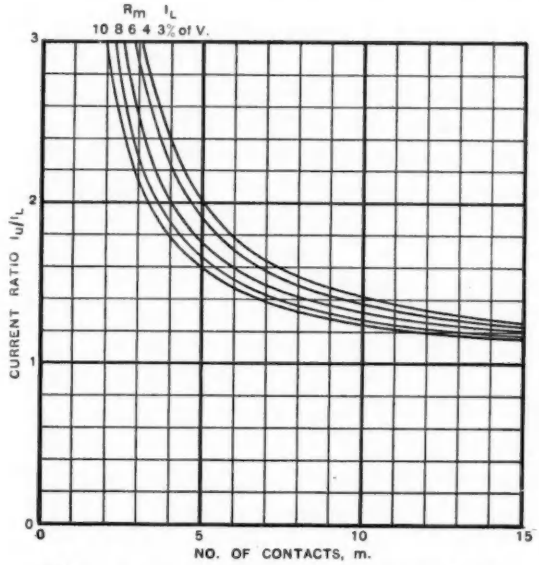


Fig. 2.—Current Ratios for a Shunt Motor.

Equation (12) may be employed to obtain the number of contacts needed to meet given conditions, but since m must be a whole number, and the solution of the equation would usually not be one, the assumed approximate value of I_U or I_L would afterwards have to be corrected to agree with that given by equation (11) when the actual number selected is substituted for m.

Current Ratios for a Shunt Motor.

Fig. 2 has been drawn to enable the correct number of contacts to be obtained by inspection. It should be noted that I_L is the lower limit of current to be employed during the starting process, and that, although it is generally equal to the full-load current, it may be greater, as explained above.

The range of 4% to 8% will include all the usual sizes of motors of ordinary design, and so the following figures may be given for the current ratio in ordinary cases:—

Number of contacts ...	4	5	6	7	8	9	10	12
Current ratio, 4% curve...	2.24	1.90	1.71	1.58	1.50	1.43	1.38	1.31
,, 8% curve...	1.88	1.66	1.52	1.43	1.37	1.32	1.29	1.23

Two points emerge from these figures and curves. First, the lower the resistance of the machine, the larger the number of contacts required for a given current ratio; or the larger the current ratio with a given number of contacts. Secondly, the reduction of the current ratio when the number of contacts is increased above seven or eight is comparatively slight. In ordinary sizes, however, it is desirable to have one or two more contacts than is absolutely necessary to comply with the specified conditions, and to base the subdivision on a fairly low value of the machine resistance. This provides a margin for quicker operation of the switch than is intended, and permits one standard startor to serve for all machines of the same power and voltage rating.

Given the values of m and of the initial and final resistances, the quickest and most straightforward method of calculating R_2, R_3, etc., is to get the $(m-1)$th root of (R_1/R_m) or the mth root of $(V/R_m I_L)$ by means of logarithms, and to divide R_1 repeatedly by this number, using a slide-rule. The fact that we should arrive at R_m after the $(m-1)$th division gives a check on the work.

Logarithms might be employed for the division, as well as for the root, but the slide-rule is quicker and gives more than sufficient accuracy. It is a waste of time to attempt to adjust the sections of the rheostat very closely to the calculated figures, for the only thing which is certain about the duty which will be required of the startor is that it will *not* be used in accordance with the conditions assumed in the calculations.

An alternative method, which is quite good, is to mark on a slip of paper the distance on the slide-rule between the marks corresponding to R_m and R_1, taking account of the relative positions of the decimal points and employing the sliding scale as an extension of the fixed one if necessary. Divide this distance into $(m-1)$ equal parts and then lay the strip along the scale again, with the end marks in their original positions. The values of R_2, R_3, etc., can then be read directly off the rule. Spring dividers could be used for the subdivision without using the paper, but their repeated application to the rule itself would quickly spoil the scales.

There is also a geometrical method, but it must be regarded as of academical interest only, because it fails to end at the right place unless the exact value of I_U/I_L has been previously calculated for the given values of R_1, R_m and m. But when that ratio is known, the whole calculation can be completed on the slide-rule in less time than it takes to make the preliminary measurements for the graphical method.

Startors for Series- and Compound-Wound Motors.

Although the theory of the shunt-motor startor is to be found in every textbook dealing with the subject, very few deal with the series-motor startor, and, of these, the two which have come under the writer's notice give entirely misleading formulæ. The makers of starting gear often find it convenient to standardise the same rheostat for both shunt and series motors, knowing that what is good enough for a shunt machine will have an ample margin when employed with a series machine.

Although we cannot give a simple formula for the resistance at each stop of a series startor, the actual calculations are easy enough.

Let a be the ratio of the fluxes with the two currents I_U and I_L; its value can be obtained from the magnetisation curve for the machine, if known, or estimated from average values. It always exceeds unity, but will be less than I_U/I_L, generally considerably less, because I_U will correspond to an excitation well above the normal. Its exact value depends upon the degree of saturation of the iron, which varies greatly from one design of machine to another. This uncertainty as to the value of a is another reason for the preference of the startor designer to neglect it in his calculations and to take its benefits in the form of a greater factor of safety rather than in a reduction of the number of steps to be used.

With the same notation and assumptions as before, we have:—

$$E_y = aE_x = a(V - R_x I_L) \quad \ldots\ldots\ldots\ldots\ldots (13)$$

or $$V - E_y = R_x a I_L - (a-1)V \quad \ldots\ldots\ldots\ldots\ldots (14)$$

Hence, $$R_y = (V - E_y)/I_U = [R_x a I_L - (a-1)V]/I_U \quad \ldots\ldots (15)$$

It is not worth while using these equations to obtain a general formula for the resistance at any contact, for the result would be complicated, whereas a numerical step by step calculation for any given case is quite simple.

Suppose, for instance, that the current limits are 150 and 100% of the full-load current, and let $a=1.2$, which is a fair average value. Then $(a-1)=20\%$. The work should be put into tabular form as follows :—

Contact No.	1	2	3	4 (Calc.)	(Actual)
$R_x aI_L$ ... ... % of V ...	—	80	48	22.4	—
$R_x aI - (a-1)V$ % of V ...	—	60	28	2.4	—
R_y ... ... % of V/I_L ...	66.7	40	18.7	1.6	say 10
Steps with shunt startor ...	66.7	35.4	18.8	—	10

In completing the table, work down the columns in order. R_1 is, of course, the total resistance $=V/I_L$. The top figure in the second column is this resistance multiplied by aI_L. Deduct $(a-1)V$ for the next figure and divide the result by I_L to get R_2. The other columns are worked out in the same way, beginning with the resistance found in the preceding column. The process is stopped when a value of R (which may then be negative) is reached not greater than the machine resistance, which will now be of the order of 10%, as it includes the series coils.

As a rule, the last calculated value of R will be less than the machine resistance, which means that the last peak of current will be a small one. The resistance might be redistributed to reduce the other peaks, except the first, at the expense of the last one, but it is better to leave them as calculated, for there is no advantage to be gained by making the subsequent peaks smaller than the first, which would compensate for the slower start which would thereby be obtained.

For the sake of comparison, the resistances required for a shunt-motor startor with the same number of steps and the same initial and final resistances have been added to the foot of the table. With constant flux, these would give a current ratio of 1.88 instead of 1.5 on the second and subsequent contacts.

We shall take one more example with current limits of 200% and 100%, $a=130\%$ and $(a-1)=30\%$.

Contact No.	1	2	3 (Calc.)	(Actual)
$R_x aI_L$ ... % of V ...	—	65	22.8	—
$R_x aI_L - (a-1)V$ ... % of V ...	—	35	−7.2	—
R_y ... ... % of V/I_L ...	50	17.5	−3.6	say 10
Steps with shunt startor ...	50	22.4	—	10

The shunt startor put in for comparison would give a current ratio of 2.24 instead of 2.00 on the second and third contacts if the flux were constant.

With a series motor the starting resistance might be cut out in a single step if a current ratio as high as 2.25 can be permitted, provided a be not less than 1.4 under these circumstances.

Comparing the startors for shunt and series motors, we see that whereas 7 or 8 contacts would be necessary for the former when the current ratio is restricted to 1.5, 4 would usually suffice for the series motor. For a current ratio of 2 the corresponding figures are 4 or 5 against 3. The reduction in the number of contacts necessary is due in part to the effect of a and in part to the greater machine resistance, because the field coils are now in the main circuit.

The method given above may be compared with that given by Dover.* In addition to the charts for his mode for working, Dover gives useful data concerning the resistance drop in motors of various sizes, and a magnetisation curve for a 7½-h.p. machine. With current limits of 100% and 150% of the full-load current that particular motor has an a of only 1.05.

* A. T. Dover, "A Universal Chart Method of Calculating the Starting Rheostats for Direct Current Motors." *Journal* I.E.E., 60, pp. 867-882. 1922.

Cable Protection.

Some methods of protecting a.c. cables under fault conditions are described with a view to illustrating underlying principles.

By A. A. F. GILES.

(*Concluded from page 539.*)

Biasing Transformers.—The principle of operation of biasing transformers is shown in fig. 5. They consist of a three-limbed core on which are three windings, P, the primary winding, is connected in series with the protective current transformer secondary windings, *i.e.*, in place of the relay coils. The secondary winding S is connected to the relay coils. Shunting the current transformer secondary windings are the biasing coils B. The connections are shown in fig. 6.

Referring to fig. 5, it will be seen that the flux due to coils B has no direct effect upon the secondary winding S except to reduce the effective flux produced by the primary winding P. Since the biasing coils shunt the current transformer they are always excited when the cable is under load and the relay has therefore an initial bias. This bias will increase with the load (and current transformer secondary volts) but is arranged to be negligible up to full load. On the occurrence of a through fault at some remote part of the system, causing a current many times the full-load current to flow, the bias on the relays increases and prevents tripping due to slight differences in the current transformer characteristics or to the capacity currents in the pilots and cables.

These transformers are also useful when dealing with parallel feeders. By cross connecting the biasing windings of two transformers it is possible to arrange, on the occurrence of a fault in one of the feeders, for the feeder carrying the fault current to give a heavy restraining action to the biasing transformer in the sound feeder. The switches in the faulty feeder will then trip out, leaving the sound feeder to carry the supply.

The McColl Biased-relay System.—This is a discriminating system which makes use of a very ingenious form of biased relay. Fig. 7 shows McColl protection applied to a feeder, one phase only being indicated. Current transformers will be seen at each end of the feeder, these transformers being interconnected through pilot wires and the special relays.

The relay consists of a pivoted beam armature. On either side of the pivot are arranged two similar electromagnets, R and O, with the same number of turns. To the end of the beam contacts are fitted to close the relay circuit. The pivot point or fulcrum is arranged slightly out of centre, being slightly nearer to the coil O, so that with the coils carrying equal current the relay has a bias off due to the coil R exerting the greater moment about the fulcrum.

Referring to fig. 7, the coils R of the relays are connected in series with the two current transformer secondary windings *via* the pilot wires. Directly across the current transformer secondary windings are also connected the coils O. In series with each coil O is a

resistance, making the resistance of this circuit equal to that of the coils R (*i.e.*, allowing for the resistance of the pilot wires).

While the feeder is sound we have equal currents flowing in both current transformers. The secondary current will divide equally between the coils O (which become operating coils) and the coils R (which become restraining coils). Owing to the mechanical out-of-balance of the beam armature, due to the coils R having the greater moment, the relay is biased off. Should a heavy load current be taken or a fault occur at some point beyond the feeder, the bias will increase, necessitating a heavier operating current to flow in the coils O before the switches trip out. This increase of bias with load removes any danger of the protective gear operating on a heavy through current, which danger might otherwise arise, due possibly to differences in the current transformer characteristics. If a fault were to develop on the feeder, as at F, fig. 7, either to earth or between phases, the current transformer at the supply end would carry the fault current, and most of the excess secondary current due to this would flow through the operating coils O of the relay, pull down the beam, and trip the switches.

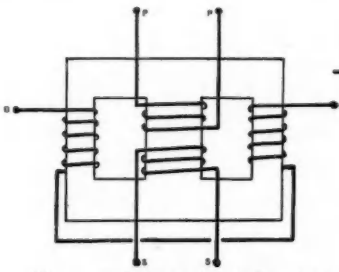


Fig. 5.—Principle of Biasing Transformer.

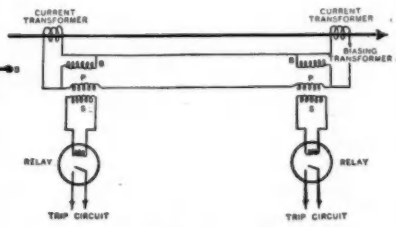


Fig. 6.—Balanced-voltage System using Biasing Transformers.

The McColl system has also been used successfully for the protection of outgoing parallel feeders. At the outgoing end McColl relays are installed. The relay in one feeder is cross connected with that in the other, so that, on the occurrence of a fault on one of the feeders, the relay in the faulty feeder operates, while that in the sound feeder is given an additional bias. By this means the object of parallel feeders in maintaining a continuous supply is attained.

The Split-conductor Protective System.—This gives complete discrimination to protected cables. The fundamental principle is shown in fig. 8. If we have two conductors in parallel with exactly the same impedances, the current in each conductor will obviously be equal. Use is made of specially constructed cables, in which ordinary single cores are split into two halves and insulated from each other. Thus each line or phase in the feeder has two conductors in parallel, which, apart from external disturbances, have exactly the same resistance and reactance. Fig. 8 shows the principle of split conductor protection applied to one phase of a feeder; in the case of a polyphase feeder the arrangement would be repeated in each phase. In the diagram it will be seen that current transformers are installed at each end of the feeder. These transformers are of special construction, and have two primary windings and one secondary winding. The splits of the cable are connected so that the two currents flow in opposite directions and the winding is non-inductive. Under these conditions, with equal currents in the splits, no secondary current will be induced to operate the relay, assuming that there is no appreciable phase displacement between the two primary currents.

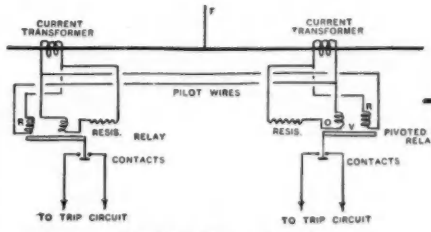


Fig. 7.—McCall Protective System with Biased Relays.

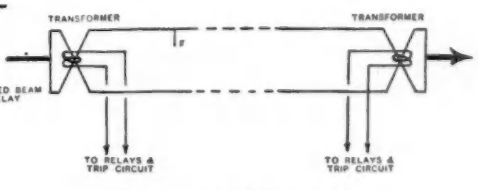


Fig. 8.—Split-conductor Protection.

Suppose a fault develops at F, fig. 8, whether to earth or between phases. If the cable is a single radial feeder (*i.e.*, with supply from one end only), there are two paths open to the flow of fault current: (*a*) through the current transformer at the supply end direct to the fault, and (*b*) through the other winding at the supply end, along the sound split in the feeder, through both of the current transformer primary windings at the receiving end and then to the fault at F.

On consideration it will be seen that the current in path (*a*) will be in excess of that in path (*b*). Due to the greater current in path (*a*), the current transformer core will be magnetised and a secondary current induced in the relay circuit, which current will operate the relay when of sufficient magnitude. Considering the current in path (*b*), the fault current flows through both of the primary windings of the current transformer at the receiving end, in an additive direction, *i.e.*, both of the windings are magnetised.

It will be seen that in the earlier stages of a fault the operation is most definite at the receiving end. If the switches at each end of the feeder are provided with double contacts for the splits, so that on the switch tripping at the receiving end the path (*b*) through the sound portion of the split is opened, leaving only the fault current in path (*a*) to operate the current transformer and relay, the tripping at the supply end is rendered very definite and immediately follows the tripping at the receiving end.

In the case of ring mains and parallel feeders, where fault current may flow into the fault from two or more supplies, the gear at each end of the feeder will function as supply ends. The effect will be greatest at the end nearest to the fault. The faulty end will therefore trip out first, being immediately followed by the tripping at the opposite end of the feeder. Faults between splits are unlikely, since the splits are well insulated, unless the cable has been damaged mechanically or by the spreading of a fault on another split. Before this could occur the gear should have operated.

Mention has previously been made of external causes which may affect the parallel operation of the splits in the cable. These causes are twofold: (1) inductive out-of-balance between splits of a phase, and (2) variations in the capacity of the splits. By taking precautions to arrange the conductors symmetrically it has been possible to overcome these difficulties.

The above notes do not by any means completely survey the subject of feeder protection; they should, however, give some idea of the principles underlying satisfactory feeder protection.

Electricity from Tidal Power.

Experimental plant designed for the production of electricity from tidal power has been erected and demonstrated at Avonmouth by Hydro Thermal Power, Ltd. The system provides for the storage of heat produced by a water-friction brake during the period of normal working of the hydro-electric plant, so that the heat can be used for the production of electricity at high-tides, when the drop is too small for the turbine to function.

Electricity for the Home.

Developments in Domestic Water-heating Equipment.

A special feature is made by NATHAN & ALLEN, LTD., of thermal-storage type water heaters, and they have a very comprehensive range of apparatus varying in size from $1\frac{1}{2}$ to 600 gallons capacity. The special advantages claimed for these "Cumulus" heaters are: efficient lagging, reducing radiation losses to the minimum; indestructible heating elements; automatic control of water temperature, preventing waste of current; no dangerous rise in pressure in the heater, due either to expansion of the water or to boiling; the cold water does not mix with the hot and so lower the temperature of the water drawn off. The design ensures the full quantity of water heated being obtained at the maximum temperature without noise or water hammer, and the room in which the heater is installed retains its normal temperature. Dust and fumes are absent, and a supply of hot water is instantly available. The "Cumulus" heater consists essentially of two concentric cylinders. The inner cylinder is made of welded mild steel, galvanised all over, designed for a working internal pressure of 70 lb. per sq. in. The outer cylinder is of sheet steel, and is made in sections and painted grey. The heating element is made of special wire wound on a supporting tube, which in turn is inserted in a copper tube flanged at one end and closed at the other. This tube is in direct contact with the water. The inside of the copper tube is filled solid with a special heat conducting, but electrically insulating, material, excluding air and preventing condensation on the inside of the tube or hot-spots on the heating element. The temperature regulator switches the current off the heater when the water reaches any desired temperature; it is usually set at about 194 deg. F. When the water temperature falls to about 180 deg. F., the current is switched on again, and it remains on until the water reaches a temperature of 194 deg. F. The regulator is contained in a protecting tube from which it may be withdrawn without emptying the boiler. The makers claim that 10 kWh will raise 22 gallons of water from 50 deg. F. to 194 deg. F.

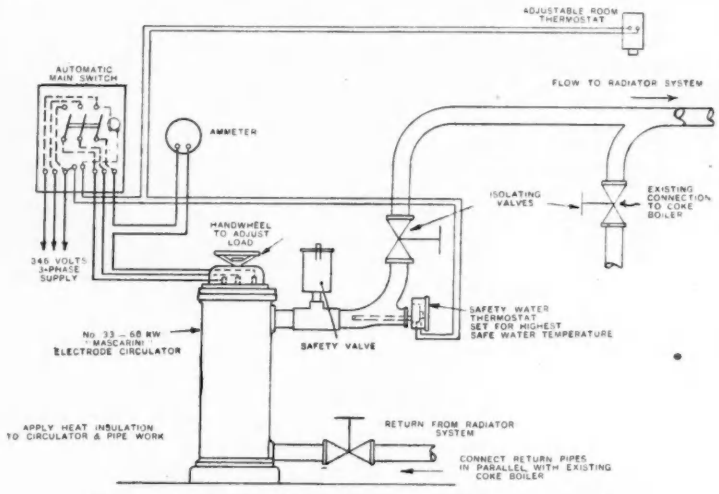
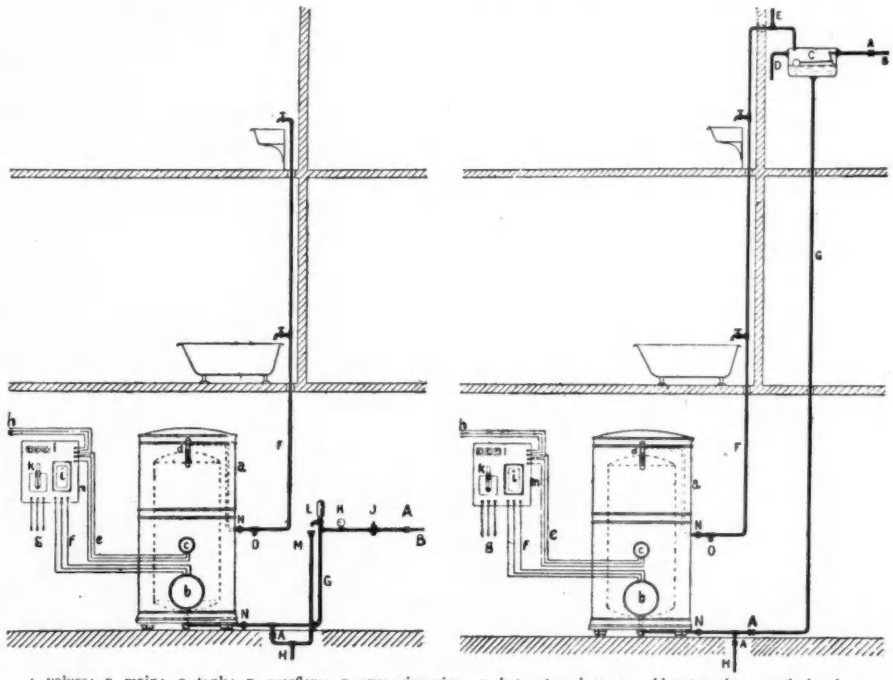

ADJUSTABLE ROOM THERMOSTAT
AUTOMATIC MAIN SWITCH
FLOW TO RADIATOR SYSTEM
AMMETER
ISOLATING VALVES
EXISTING CONNECTION TO COKE BOILER
HANDWHEEL TO ADJUST LOAD
346 VOLTS 3-PHASE SUPPLY
SAFETY WATER THERMOSTAT SET FOR HIGHEST SAFE WATER TEMPERATURE
No. 33 – 60 RW "MASCARINI" ELECTRODE CIRCULATOR
SAFETY VALVE
APPLY HEAT INSULATION TO CIRCULATOR & PIPE WORK
RETURN FROM RADIATOR SYSTEM
CONNECT RETURN PIPES IN PARALLEL WITH EXISTING COKE BOILER

Fig. 1.—" Bastian " Electrode Circulator Installation.

The "Cumulus" heater can be placed in any convenient position from cellar to attic; the important point is that it should be in the position where the shortest run of hot-water pipe is needed, in order to minimise radiation from the pipes. The two diagrams in figs. 2 and 3 show the runs of the water pipes with and without a ball-cock tank.

The latest developments of the BASTIAN METER CO., LTD., in electric water heating have been in the production of equipments for large private houses, hotels, &c., which are usually heated by a hot-water radiator system



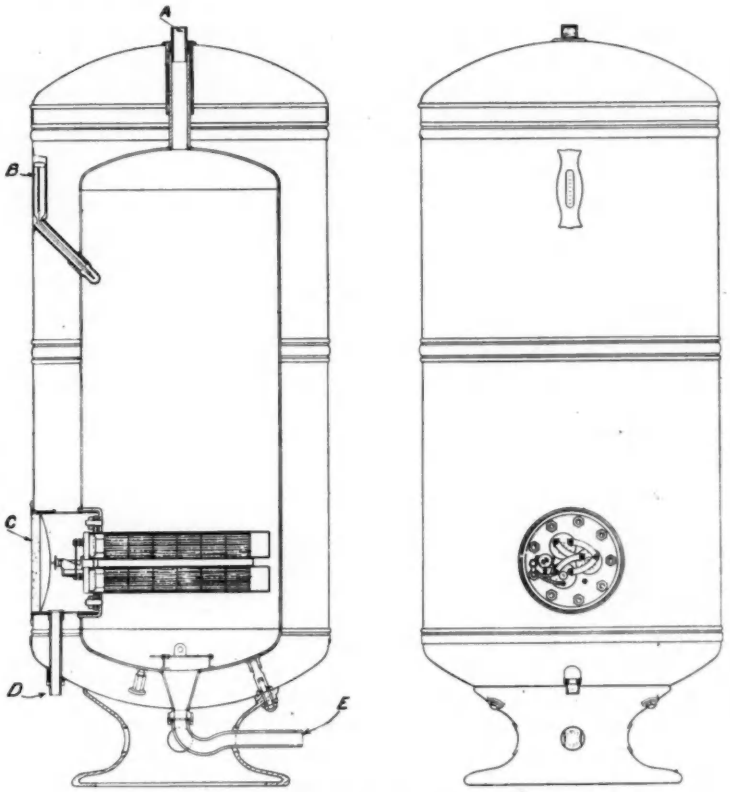
A, valves; B, main; C, tank; D, overflow; E, expansion pipe; F, hot-water pipe; G, cold-water pipe; H, drain pipe; N, couplings; O, air cock; J, reducing valve; K, pressure gauge; L, safety valve; M, waste pipe.
a, "Cumulus" heater; *b*, heating element; *c*, temperature regulator; *d*, thermometer; *e*, mains from temperature regulator to remote control switch; *f*, mains from remote control switch to heating element; *g*, main from meter; *h*, main from relay time switch; *j*, remote control switch; *k*, hand-operated switch; *l*, fuses; *m*, panel.

Figs. 2 and 3.—" Cumulus " Water Heating Installations.

and a coke or coal-fired boiler. The method employed is to fix a hot-water electrode circulator alongside the present coal boiler, as shown in fig. 1, the electric heater being controlled, either by a triple-pole hand switch or by a 3-pole contactor and thermostat. The actual load can be easily adjusted by turning the hand wheel shown at the top; for example, with the smallest size heater the load is variable from 7 to 25 kW. The load is adjusted to meet the varying circumstances; in the autumn, the load is left at the minimum and controlled by the contactor; as the weather gets colder the load can then be increased, and in this way the minimum load is left on for a long time. Besides forming a partial "off-peak" system the hot-water electrode circulator has many advantages in that it appeals to the consumer who has already got a hot-water heating system, as it is easily installed, robust, and entails no maintenance costs. For domestic hot-water supply the Bastian Company finds that usually a considerable saving can be obtained by fitting one of its domestic water heaters locally, but the circulator can also be adapted for giving instantaneous hot-water supply.

The electric water heaters of Ferranti, Ltd., based upon the thermal-storage principle and hitherto available only in the large sizes, are now offered in a wide range of standard sizes to meet every conceivable domestic need, the smallest having a capacity of 2 gallons. The loading characteristics most attractive to the electric supply authority are generally presented by the use of large heaters, preferably with suitable means of control to restrict their loadings to off-peak conditions of the supply system; but the use of small heaters which cannot reasonably be restricted as to their hours of loading, and which, therefore, do not generally rank as entitled to the specially low tariffs which may be offered for heaters of larger sizes, is often justified in practice as a means of reducing heat losses due to excessively long pipe runs. It has been found, too, that an inexpensive small heater often affords an excellent means of first introducing a consumer to a realisation of the great comfort to be obtained from electric water heating in the house. The main features claimed for the "Ferranti" equipment are: the containers are of very-heavy-gauge material, with welded seams, tested to withstand a pressure of not less than 90 lb. per sq. in.; the withdrawable heating elements run at a low temperature to ensure long life and to minimise furring troubles with hard water; the very robust thermostat used has a wide range of adjustment; unusually heavy lagging of granular cork to a thickness of 4 in. is employed in all but the smaller sizes. The heaters are made for connection to a separate ball-valve cistern to give a general supply throughout the house; or for connection direct to the water main for operation on the displacement principle, to give a supply of hot water at one point only; or with a self-contained ball-valve cistern, thus constituting a complete unit for hot-water supply.

Heaters of the very small sizes are arranged for wall mounting only. The medium sizes are suitable either for mounting on the wall or on a stand, whilst the large sizes are provided for standing direct on the floor. A new range of heaters has lately been produced to meet the detailed requirements of an electricity supply undertaking with a very wide experience in the operation and maintenance of water heaters of a wide variety of makes, both British and foreign. In this range, the heating elements are horizontally mounted in all sizes from 10 gal. upwards, thus reducing the amount of vertical accommodation required for their installation. Fig. 4 shows the arrangements of the 20- and 60-gallon "Ferranti" water heaters.



A, outlet pipe; B, thermometer; C, element and thermostat pocket; D, conduit to element and thermostat; E, inlet pipe.

Fig. 4.—Construction of 20- and 60-gallon "Ferranti" Water Heaters.

The new "Gee-Gee Corporation" wash boiler has been produced by George Green and Co. to fulfil the need for a strongly built competitively priced article. It is a suitable appliance for housing or hire-purchase schemes, and it bears a guarantee of 2 years against faulty workmanship or material. This wash boiler has a capacity of 10 gallons. The inner container is constructed of tinned copper, the outer case and lid of galvanised iron, and the exterior is enamelled green. The whole is mounted on 3 cast-iron feet, and is in all respects a sound engineering job. The heating equipment comprises a standard "Gee-Gee" 3-kW immersion heater, which is accommodated in a sump at the bottom of the inner container, and protected from the clothes by a removable perforated lift-off cover. A brass draw-off tap with an ebonised-wood grip handle is arranged to empty the boiler to sump level.

The following extras can also be supplied with the boiler if desired: a 3-heat series-parallel switch mounted on a wood block and connected to the boiler by means of 4 ft. of 4-core c.t.s. cable; a copper lid tinned underneath and polished outside; a sump tap; a spraying device which forces a continuous supply of boiling water through the clothes, loosening the dirt and lightening the labour; and an "accident-proof" immersion heater, in lieu of the ordinary heater, which switches off automatically if the boiler is allowed to boil dry, or is switched on empty.

The "Gee-Gee Junior" wash boiler by the same company has been produced especially for housing and hiring schemes and to meet gas competition. It is in all respects similar to the "Corporation" boiler, but is slightly smaller. Its capacity is 8 gallons, which will be found large enough for the small household, and the loading is 2,500 watts.

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations, and Failures.

The E.D.A.-E.L.M.A. Campaign.

An inaugural luncheon in connection with the E.D.A.-E.L.M.A. Shop and Display Lighting Campaign was held at the Connaught Rooms, London, W.C., on Monday last. The chair was occupied by the President of the British Electrical Development Association (Alderman E. Huntsman), who, before proceeding with his address describing the methods and aims of the Campaign, asked those present to rise as an expression of sorrow at the loss of the brave men who perished in the disaster to the airship R.101. In his address, Ald. Huntsman showed that adequate and properly-applied illumination in shops and shop-windows was a definite means of selling more goods. Merchandise was thus shown to better advantage, customers were attracted to the shop, and the lighting had an immense psychological effect upon the customer. In view of this it would have been thought that this "nation of shop-keepers" would have been anxious to avail themselves of the service of light, but a survey carried out as a preliminary to the Campaign revealed that out of about half-a-million shop-windows in this country 450,000 were lighted by naked lamps, out-of-date fittings, or by a wasteful ill-disposed arrangement. In spite of the beauty and attraction of illuminated facias and external display lighting, fewer than 5,000 shops were employing these devices. The public did not appreciate that, consequent upon the improved efficiency of lamps and generating plant, electric light could be purchased at one-third of the pre-war cost. To impress upon the retailers of this country that selling meant display and that display meant light, 600,000 letters and booklets were being circulated to them; conferences were being held in various important cities; shop and display lighting demonstrations of a practical kind were being arranged; and lectures, illustrated by lantern slides and by a portable window, were being given. The organisers had the assistance of the National Display Association, sales managers' associations, chambers of trade and commerce, rotary clubs, and sign-making interests, as well as the help of the Press of the country. The speaker said that he looked forward to a land of brighter cities, where even the village shop would have emerged from the single oil-lamp period and the smallest streets in country towns would be flooded with the cheering light of generously-illuminated shop-windows. Proposing a vote of thanks to Ald. Huntsman, Mr. Austin Reed showed that he appreciated the value of good lighting and expressed his envy of the fortunate electrical contractor who had such an enormous scope for his energies. Mentioning some of his experiments in illumination, he said that he was greatly impressed by a system of indirect lighting which he had seen in Philadelphia, U.S.A. He had had a similar system installed in two of his provincial branches, but it was found that the customers regarded the result as cold and cheerless. He also stated that he had had a unique installation put in at a hairdressing saloon run by his company. Mr. H. Marryat, seconding the vote of thanks, confessed that he took a brighter view of his prospects since listening to Mr. Reed's remarks.

The first public appearance in the London area of the mobile exhibition of electric signs, arranged by the Master Sign-makers' Association in connection with the campaign, took place last Tuesday outside the showrooms of the Battersea Corporation Electricity Department. The exhibits are mounted on a large saloon motor-coach, and at night time present a most attractive and impressive appearance. All the usual types of sign are displayed, including a large number of window, box, reflecting, floodlighted, moving, and changing-colour signs; there are also exhibits of electrical news panels and scintillating signs, as well as devices for day and night advertisement. Those members of the Association taking part in the exhibition are:—Messrs. J. Akers; Ascog, Ltd.; Attracta Electrical Co.; Burnham & Co.; Changeable Sign Co., Ltd.; H. T. Bush; B. Edmett & Co.; Imperial Lighting Co.; Johnson Signs; K.F.M. Engineering Co., Ltd.; Laidlaw Publicity; Nucynes; Oliver White, Ltd.; Pearce Sign Works; Russell Signs, Ltd.; Shirland Metal Works; Sign Construction Co., Ltd.; Simplex Conduits, Ltd.; Solanite, Ltd.; Strand and Interchangeable Signs, Ltd.; and H. W. Stroud. The coach is to make a nine weeks' tour of the country, starting with the South Coast.

The West Hartlepool Town Council has given sanction to a scheme outlined by the electrical engineer for co-operation with the electrical contractors and electrical appliance dealers of the town in the promotion of an exhibition of modern shop window lighting under the auspices of the British Electrical Development Association. It is proposed to have two model windows, one showing the prevalent system of lighting and the other lighted according to the latest ideas. The local contractors had agreed to do all the necessary wiring, &c., and the Corporation is to supply all electricity required free of charge.

The General Electric Co., Ltd., is identifying itself in an active manner with the campaign for better shop lighting and has issued a well illustrated broadsheet in colours, dealing with modern shop lighting systems. This publication covers every phase of shop lighting, including interior lighting, window lighting, facia lighting, and also interior and exterior sign lighting, including "Internalite" directional signs and "K.-Ray" and "Claude-General" neon signs.

United States Electrical Exports.

During July last the exports of electrical equipment from the United States had a value of $9,550,395, a decrease of $3,164,043 as compared with July, 1929. Exports of d.c. generators remained at about the same level, but those of a.c. generators fell by about $91,000. The exports of steam turbo-generator sets, however, increased by $113,000. Storage batteries were about $50,000 up, but transforming and converting apparatus showed a fall of $125,000. Under the heading "motors, starters, and controllers" there was a decrease of $493,000, and refrigerators were lower by $448,000. Large decreases also occurred in the cases of motor-driven household devices ($110,000), radio apparatus ($284,000), telephone apparatus ($237,000), and insulated copper wire and cable ($149,000).

Canada, the principal importer of this equipment, took goods to the value of $2,390,775 (a decrease of $1,486,019 as compared with July, 1929). Other leading customers were Argentina, $785,810; the United Kingdom, $663,229; Mexico, $546,506; Soviet Russia, $452,432; and Brazil, $303,063 (a decrease of $600,383). Imports of electrical goods into the United States during July amounted to only $174,148; the United Kingdom supplied transformers valued at $32,619.

Motor Battery Standardisation.

The Society of Motor Manufacturers and Traders, in conjunction with the Institution of Automobile Engineers, has just issued two sheets of provisional standard dimensions for the 6-V batteries used in connection with the electric lighting and starting equipment of commercial motor vehicles. The standards relate to the dimensions of battery crates or moulded containers, terminal parts, and cable connections.

Costing—an Aid to Management.

The Master Cutler-Elect (Mr. P. P. Brown, M.Inst.C.E.) will preside over a meeting of works directors and business executives at the Cutlers' Hall, Sheffield, on October 24th, when a paper on "Why Cost Accounting is Vital to Efficient Management" will be read and discussed. This meeting is part of the programme of the Ninth National Cost Conference which will be held in Sheffield on October 24th and 25th under the auspices of the Institute of Cost and Works Accountants.

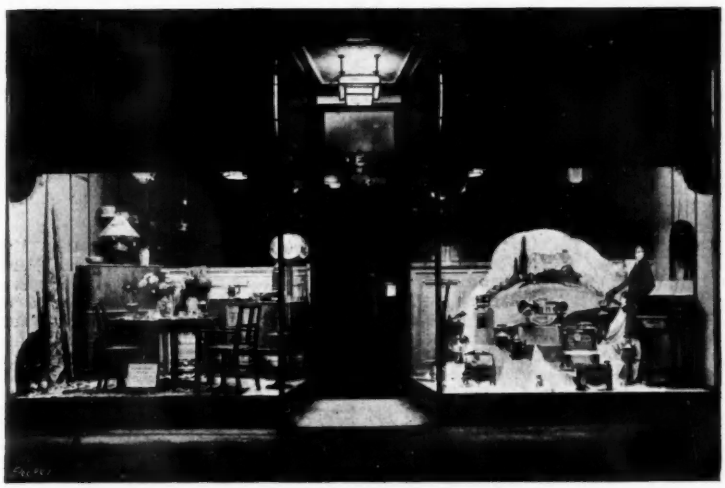
Australian Manufacturers' Alleged Apathy.

Owing to criticism of the Victorian Electricity Commission by the Australian Natives' Association, which stated that before asking British firms to supply details of their electrical equipment the Commission should have given Australian manufacturers every opportunity of tendering for supplies, the Commission has issued a statement of its reasons. This says that of 46 Australian firms written to for details of farm electrical equipment, 32 did not even acknowledge the letter, and of the 14 which did reply six were only importers. The Commission therefore regards the response of Australian firms as very disappointing.

Swedish Industry and Trade.

The September issue of the *Swedish Economic Review* (the official journal of the Swedish Board of Trade) says that during the spring and summer economic depression was felt increasingly in Swedish industrial life. The level of prices continued to fall and production declined—particularly in the export industries. Employment in the electrical trade during the June quarter was good on the whole, though not quite so good as in the first quarter. There was increased employment in the lamp factories and instrument works.

The exports of electrical machinery during the first seven months of the year were valued at 20,080,000 kr. (£1,115,000), against 18,283,000 kr. (£1,015,000) in the corresponding period of 1929. Telephone and telegraph apparatus exports had a value of 8,747,000 kr. (£486,000), as compared with 7,474,000 kr. (£413,000).



The Surbiton Electrical Showrooms.

The G.E.C. Swansea Branch.

The growth of the Swansea branch of the General Electric Co., Ltd., has necessitated the provision of new premises, and the new Magnet House, in Northampton Place, was formally inaugurated on October 2nd. The premises comprise three floors, with a basement, and there are seven display windows, which will serve to exhibit the wide variety of goods manufactured by the company, under a system of illumination, which will both demonstrate modern methods of shop window lighting and permit detailed examination of products. The ground floor, as will be seen from the accompanying illustration, is devoted to the display of a variety of lighting fittings, "classic" and modern, and a comprehensive range of electric fires, while on the first floor is the electric kitchen, which is equipped with everything electrical that can be regarded as contributing to cleanliness and comfort, including a cooker, wash boiler, warming plates and grills, kettles, &c. Demonstrations of the various appliances are given under actual working conditions. There is also a wide selection of "Gecophone" wireless sets, loud-speakers, &c., on this floor. The whole of the basement and the top floor have been assigned to stock purposes, while the trade counter is situated at the side of the premises. The whole of the heating of the building is carried out with "Magnet" tubular heaters, and the general lighting consists of "Britalux" pendants and "Superlux" reflectors. The new premises were inaugurated by Mr. J. W. Burr, borough electrical engineer of Swansea, and later the company was entertained to luncheon at the Hotel Metropole. Mr. Burr reviewed the growth of the company during the past 40 years. Mr. H. W. Roberts, a director of the company, said they employed 27,000 people, and had been able to add 3,000 during the last twelve or fifteen months. The manager of the Swansea branch is Mr. H. C. Runnals.

The New Swansea Branch of the G.E.C.

New Italian Companies.

Among the companies recently formed in Italy are La Società Comunicazioni Elettriche Albanesi, Rome, capital 100,000 lire; and La Società Elettrochimica Maremmana, Rome, 2,000,000 lire.

New Electrical Showrooms at Surbiton.

The urban district of Surbiton is essentially a residential area, and the demand for electricity, therefore, is almost entirely a domestic one. The need for publicity has been felt for some time past by Surbiton Electricity Supply, and this has been met by new showrooms at 22, Claremont Road, which were inaugurated on September 30th by the chairman of the Council. The site has been well chosen, being in the central part of the town, and will attract existing and prospective consumers. The showrooms have double display windows in which domestic appliances have been attractively arranged, and the display is enhanced at night by the judicious use of concealed lighting. Behind the shop is an all-electric kitchen containing an electric cooker, refrigerator, water heater, and other appliances for kitchen use, while on the floor above is the showroom proper, where lighting fittings, vacuum cleaners, irons, and a host of other appliances are on show. The two floors above this are used for offices and storerooms. At the opening ceremony Mr. H. Foulds, secretary of Callender's Cable and Construction Co., Ltd. (proprietors of the undertaking), who presided in the unavoidable absence of Sir T. O. Callender, briefly outlined the history of the undertaking, and said that in passing to the control of the London and Home Counties Joint Electricity Authority the undertaking would be in the hands of a body whose motive was to supply ample electricity at the lowest possible cost. Councillor R. H. Ferguson then declared the showrooms opened. Mr. W. F. Marchant, chairman of the London and Home Counties Joint Electricity Authority, said they were now in a position to start work at Surbiton. They were going to set up a standard of comparison which would enable Parliament to decide whether the business should be handed over to authorities such as theirs. The Authority became the nominal owner of the undertaking on Wednesday last, but Messrs. Callender's will continue to manage it until the legal documents have been completed. The resident engineer and manager is Mr. E. S. Saunders. An exterior view of the showrooms is shown in the accompanying illustration.

An Important New Telephone Undertaking.

The formation is announced of the General Telephone and Electric Corporation with a capital of 5,000,000 common shares of which 124,000 will be taken up by the parties concerned at $50 per share. The object of the new concern is to extend the business of the Associated Telephone & Telegraph Co., with which three British companies are connected—the Automatic Telephone Manufacturing Co., Ltd., the International Automatic Telephone Co., Ltd., and the Telephone, Cable and General Trust, Ltd. Sir Alexander Roger is chairman of these companies and will be a director of the new Corporation. The chairman of the latter will be Mr. H. L. Gary, president of Theodore Gary & Co., who, with the Trans-America Corporation, are responsible for the merger. It is stated that there will be no public issue by the Corporation.

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Belfast Electrical Exhibition.

The electrical exhibition organised by the Corporation Electricity Department, assisted by manufacturers and wholesalers in Northern Ireland and members of the Electrical Contractors' Association, was opened by the Minister of Commerce at Ulster Hall on October 2nd. The Lord Mayor, who presided, said that it was seven years since such an exhibition had been held in Belfast. In that time the output of the electricity department of the city had increased from 37 million to 65 million kWh and charges had been considerably reduced, the average price per kWh for an electrically-equipped house being about three-farthings.

The lay-out of the hall was well arranged and there were over 300 exhibits. The hall vestibule contained a striking series of exhibits by the Electrical Development Association in a model shop window, lighted to display the commodities. Two ante-rooms were devoted to radio apparatus and refrigerators. The main hall was taken up by a wide selection of domestic appliances, while the minor hall was devoted to industrial exhibits including such diversified exhibits as automatic signalling apparatus, hand drills, welding plant, hoists, fire alarms, &c. Prominent among other electrical manufacturers were the General Electric Co., Ltd., and the Metropolitan-Vickers Electrical Co., Ltd.

Cable and Wire Prices Reduced.

We have received from the Edison Swan Electric Co., Ltd., 155, Charing Cross Road, W.C.2, a circular announcing reductions in the price of wires and cables as from September 11th, and giving details of the rebate discounts on yearly contracts which remain unchanged.

A Large Railway Contract.

The Southern Railway has placed with the Metropolitan-Vickers Electrical Co., Ltd., an order for the supply of complete electrical equipments, including the necessary motors, control gear, lighting, heating, and compressor apparatus, for 104 motor coaches and 104 trailer coaches. The greater part of the apparatus is for the new rolling stock to be used on the forthcoming electrified service to Brighton. The apparatus for this service comprises electrical equipments for forty 4-coach train units, each unit consisting of two motor coaches and two trailer coaches. The remainder of the apparatus is for general extension to the rolling stock of the electrified system and comprises electrical equipments for twelve 3-coach train units and six 2-coach trailer units. The new equipment will be similar to that which has been supplied by the Metropolitan-Vickers Co. on previous contracts. Each motor coach will be equipped with two 275-h.p. motors of the totally-enclosed self-ventilated type. These are arranged in pairs on the bogies underneath the driving compartments at the two ends of the train unit. The control gear will be of the Metropolitan-Vickers all-electric type with automatic acceleration. An interesting and novel feature of the heating equipment for the Brighton service will be the provision of electric water heating for the lavatory compartments. The power for this purpose will be taken from the 600-V main and each heater will be controlled by a contactor which is automatically operated when the water-tap is turned on or off. This contract is the sixth of considerable magnitude which has been placed with the Metropolitan-Vickers Co. for train equipments for the Southern Railway. It will bring the total of "Metrovick"-equipped stock on the system to 668 motor coaches and 864 trailer coaches. The value of the contract amounts to rather more than £250,000.

Midland Contractors at G.E.C. Lamp Works.

On October 2nd a party of nearly a hundred electrical contractors from Birmingham, Nottingham, Coventry and Wolverhampton visited the Hammersmith and Wembley lamp works of the General Electric Co., Ltd. They were accompanied on the journey by Mr. A. J. Pimm, manager of the lamp department of the Birmingham branch, and Mr. Boyes, and were entertained to luncheon at the Clarendon Restaurant, Hammersmith, where they were welcomed on behalf of the company by Mr. G. Chelioti, joint works manager. Mr. J. Y. Fletcher, director and sales manager, said the company was aiming at raising the annual sales of electric lamps in this country from 50,000,000 to 100,000,000. At the new Wembley factory, when production was properly established, it was hoped to manufacture 25,000,000 lamps annually, in standard lines, in addition to the 24,000,000 now made at Hammersmith. Mr. Asdell, of Parker, Winder, & Achurch, Birmingham, thanked the company for its hospitality.

Dundee and Foreign Cable.

Dundee Town Council again discussed at its meeting on October 2nd the question of the acceptance of British or foreign offers for the supply of electric cable. Mr. W. Dunn, convener of the Electricity Committee, moved that the lowest offer by foreign manufacturers be accepted, remarking that they would lose £459 if they accepted a British offer as against the lowest foreign offer. Lord Provost Johnston, in moving that they accept the lowest British offer, said that it was only 13 per cent. more than the foreign offer. By 16 votes to 13 it was decided to accept the foreign offer.

The Greater Felcourt School.

Mr. R. Borlase Matthews has sent us a prospectus of the Greater Felcourt School, East Grinstead, of which he is chairman of governors. It is claimed that students at this school receive more individual tuition than is customary at most institutions of the kind and the arrangements and equipment are very modern.

Unemployment.

There was an increase of 6,245 in the number of registered unemployed during the week ended September 22nd. At that date the total was 2,109,658, as compared with 2,103,413 on September 15th, and 1,162,940 on September 23rd, 1929.

Local Exhibition.

Burnley Corporation Electricity Committee is to hold an electrical exhibition at the Mechanics' Institution from December 4th to 15th.

Canadian Trade Consultations.

The Department of Overseas Trade announces that Mr. F. W. Field, Senior Trade Commissioner in Canada and Newfoundland, will be in attendance at the offices of the Department during the month of October. He will be pleased to meet by appointment representatives of manufacturers and merchants interested in the export of British goods to Canada. At a later date he will visit a number of industrial centres in the Provinces. Applications for appointments with Mr. Field in London should be addressed to the Comptroller-General of the Department, 35, Old Queen Street, S.W.1. (Reference No. 3081/1/1930.)

The Need for Advertising.

We have received from Messrs. Spottiswoode, Dixon and Hunting, Ltd., Regent House, Kingsway, W.C.2, an illustrated brochure presenting a reasoned argument in favour of effective and consistent advertising. The illustrations comprise examples of advertisements designed to appeal to various classes of reader.

A Large Industrial Canteen.

We have received from the Publication Department of Bournville (Cadbury's) Works an illustrated booklet (20 pp., price 6d.) dealing in some detail with the very excellent catering arrangements which have been instituted at Bournville. It should prove a useful guide to other large concerns who are contemplating the establishment of a canteen for their employés. We notice that a good deal of electrical apparatus is installed in the kitchen, including cooking equipment (seven ovens) with a total loading of 59 kW, two-double 8-kW grillers and two 8-kW fish fryers by the Jackson Electric Stove Co., Ltd.; a Metropolitan-Vickers single-sack electric baking oven (50 kW); "Hobart" mixers and crockery-cleaning machines; and a "Frigidaire" refrigerating machine.

Bankruptcy Proceedings.

F. C. Smithers, late 117, Ashdon Road, Saffron Walden, Essex, electrical engineer.—The public examination of this debtor was held recently at the Guildhall, Cambridge. According to the statement of affairs there were liabilities of £437 and assets of £16, leaving a deficiency of £421. The debtor attributed his failure to saturation of the trade in Saffron Walden, lack of capital, and also to a slight accident which he met with in 1929, through which he had to pay men to do his work. The examination was adjourned for closing.

J. C. K. Birkett, 1, Scotland Road, Carnforth, Lancs., wireless dealer.—The public examination herein was held at the Sessions Hall, Preston, recently. The statement of affairs submitted showed gross liabilities of £301, and a deficiency of £109. The debtor said that he commenced trading as a wireless dealer in September, 1922. In 1924 he formed a partnership, which was dissolved later, and the debtor recommenced on his own in 1928. His drawings from the business had often been more than the profits. The examination was adjourned.

F. J. Jervis and W. H. Pollner (The Abbey Radio Service), radio engineers, 1, Blenheim Passage, St. Johns Wood, N.W.—Receiving order made September 30th, on debtors' own petition. First meeting, October 13th, and public examination, November 13th, both at Bankruptcy Buildings, Carey Street, W.C.

W. Mann, late of 128, Evington Road, Leicester, wireless dealer.—The public examination was held at the Castle, Leicester, on October 3rd. The debtor's deficiency was stated to be £313. He attributed his failure to ill-health. The examination was closed.

P. R. H. Baynton (The Scunthorpe Service and Charging Depôt), 38, Wells Street, Scunthorpe.—First meeting, October 11th at the Official Receiver's office, St. Mary's Chambers, Great Grimsby. Public examination, November 6th, at the Town Hall, Great Grimsby.

C. S. Hill (Sanderson Hill & Co.), electrical factor, Waltham Chambers, Waltham Street, Hull.—Application for discharge to be heard on November 12th at the Guildhall, Alfred Gelder Street, Hull.

J. A. Henderson, electrical contractor, 28a, Basinghall Street, E.C.—Last day for receiving proofs for dividend, October 18th. Trustee, Mr. D. C. Evans, 44, Gresham Street, E.C.2.

J. A. Cane, T. P. Cane, and D. R. Cane (Cane Brothers), consulting and electrical engineers, Sturry, Kent.—Last day for receiving proofs for dividend, October 25th. Trustee, Mr. S. E. Foster, 29, Bank Street, Ashford.

W. G. Conway ("Listron"), wireless component dealer, 88-90, Chancery Lane, W.C.—First and final dividend of 2½d. in the £, payable on October 14th at 78, New Oxford Street, W.C.

Company Liquidations.

Sphinx Electric, Ltd.—As we briefly mentioned in our last issue, the statutory first meetings of creditors and shareholders of this company were held at Carey Street, W.C.2, on September 30th. Mr. G. D. Pepys, Senior Official Receiver, reported that the company was registered as a public company in January, 1929, with a capital of £300 increased to £150,000 in February, 1929. It was formed to acquire and carry on the business of manufacturers and dealers in electric lamps and other electrical apparatus then being conducted by Auto-Bulbs, Ltd. The promoter was Mr. C. P. Preston, managing director of Auto-Bulbs, Ltd., who died in June last. He was appointed managing director of this company for seven years from March 29th at a salary of £1,500 per annum and had absolute control of its affairs. The issued capital was £122,622, of which £41,000 was allotted as fully paid to Auto-Bulbs, Ltd., in part payment of the purchase price for that company's business together with the trade-mark "Sphinx," the balance (£47,000) being paid in cash. The purchase price included £16,000 for goodwill. A prospectus was issued on February 25th, 1929, inviting public subscriptions for £101,500 of the company's capital and applications for £81,623 were received. The trading of the company resulted in a gross profit of £11,877 on a turnover of £31,351, but a net loss of £14,928 after charging overhead expenses. In addition a sum of £11,675 was paid out for preliminary and formation expenses. A draft statement of affairs has been lodged showing unsecured debts of £12,795 against assets valued at £3,061. The failure of the company was attributed (1) to the fact that the assets of Auto-Bulbs, Ltd., were taken over at a figure which bore no proportion to their real value; (2) to unprofitable contracts; and (3)to extravagant and excessive overhead expenses. The liquidation was left in the hands of the Official Receiver, who is to be assisted by a committee of inspection.

Fellows Manufacturing Co., Ltd., Cumberland Avenue, Park Royal, N.W.—The statement of affairs lodged under the compulsory liquidation of this company shows total liabilities of £120,693 (unsecured £60,813), assets of £1,993, and a deficiency of £189,049 with regard to contributories. The following are the principal creditors:—

	£		£
Accumulators (Woking 1928), Ltd.	607	Laurence Messer & Co.	418
Bishops, G. Rendel ...	511	Murphy Casson, Ltd.	10,944
Corporate Finance, Ltd.	16,891	Mullard Wireless Service Co., Ltd. ...	453
Fellows, Mrs. M. E. ...	227	Marconi's Wireless Telegraph Co., Ltd.	1,281
Fellows, D. V. L. ...	393	Mackie, E.	400
Joseph, H. C., Ltd. ...	280	Oetzmann & Co., Ltd.	266
J.S.A., Ltd.	3,816	Patent Die Castings Co., Ltd.	540
James, Son & Andrew	282	Wild & Co.	966
Jackson, H. F. ...	456	Jackson, H. F.	343
Lowden, T. W.	1,525		

Bordesley Electrical Accessories Co., Ltd.—Meetings of members and creditors are to be held on November 5th at the offices of Mr. A. Brown, Daimler House, Paradise Street, Birmingham, to hear an account of the winding-up of the company by the joint liquidators, Mr. A. Brown and Mr. W. Hand.

Fell, Anderson & Co., Ltd.—A meeting of members is called for November 10th at the offices of Messrs. Fogg, Wynne and Fogg, 14, Water Street, Liverpool, to hear an account of the winding-up of the company by the liquidators, Mr. W. R. MacGregor and Mr. T. S. Fogg.

Ashworth & Smith (Electrical Supplies), Ltd.—A meeting of members will be held at the offices of Ashworth and Smith, Bridgewater House, Whitworth Street, Manchester, on November 6th, to receive an account of the winding-up of the company by the liquidator.

Dudley, Stourbridge & District Electric Traction Co., Ltd.—Winding up voluntarily. Liquidator, Mr. R. P. Beddow, 88, Kingsway, W.C.2.

Ramsbury Electric Supply Co., Ltd.—Particulars of claims by October 29th to the liquidator, Mr. C. A. V. Slade, 14, Old Jewry Chambers, E.C.2.

Private Arrangements.

W. Backhouse and J. P. Longhurst, trading as Backhouse and Longhurst, 126, East Hill, and 4, High Street, Wandsworth, S.W., wireless dealers.—At a meeting of creditors on October 1st a statement of affairs was presented which disclosed liabilities of £685 and assets of £164, leaving a deficiency of £521. It was stated that the average takings had recently been about £50 weekly. The debtors wished to continue trading and made an offer of a composition of 4s. in the £. A resolution was passed agreeing to accept 5s. in the £ payable as to 2s. 6d. in November next and 2s. 6d. at the end of February, 1931. A committee of inspection was appointed. The following are principal creditors:—

	£		£
Fuller Accumulator Co., Ltd.	47	L.E.S. Distributors, Ltd.	40
Pertrix, Ltd.	45	Carrier Cycle Co.	31
		Auto Sundries, Ltd. ...	24

New Catalogues and Lists.

The Arora Co., Loughborough.—A new list of "Arora" fires and a leaflet describing an electric iron.

Heyes & Co., Ltd., Water-Hayes Electrical Works, Wigan.—Folder L.2, illustrating a new universal type of "Lacent" lighting fitting.

The B.E.N. Patents, Ltd., 92, Tottenham Court Road, London, W.1.—A leaflet describing the B.E.N. lightning rotary striper suitable for making stripes on automobile bodies, wheels, bodies, &c.

Imperial Chemical Industries, Ltd., Millbank, London, S.W.1.—An interesting booklet describing the results of experiments on the effect of aluminium on brass and leading up to the manufacture of "Alumbro" condenser tubes.

The Visco Engineering Co., Ltd., 162, Grosvenor Road, London, S.W.1.—A well-illustrated publication (No. 301) giving particulars of industrial vacuum cleaners.

Siemens Electric Lamps & Supplies, Ltd., 38-39, Upper Thames Street, London, E.C.4.—An excellently produced catalogue (No. 430), containing 76 pages, dealing with all types of electric lighting accessories; also list No. 355, setting out clearly a wide range of wireless valves.

The Marconiphone Co., Ltd., 210-212, Tottenham Court Road, London, W.1.—A new radio valve catalogue designed to assist both the non-technical and the more advanced listener.

Petters, Ltd., Westfield Works, Yeovil.—The September issue of *Petter's Monthly News* containing an interesting article on the present economic conditions entitled "Hard Times."

The General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2.—Leaflet No. F.4198, describing industrial reflector lighting fittings; a descriptive leaflet (S.L. 5,528) dealing with the company's recently-introduced slider and metallic type dimmers for stage lighting; and four well-produced leaflets (F5465, F5467, F5468, and F101), which illustrate the 1930-31 season's lighting fittings comprising a new range known as the "Emblique" type of candle fitting in old English bronze and old silver colour. This new fitting is designed to hold colour-sprayed or pearl lamps, or the new Osram "Gothic" type of candle lamp.

Equipment & Engineering Co., Ltd., 2 and 3, Norfolk Street, Strand, W.C.2.—A leaflet giving particulars of an electric tire heater for use in railway and tramway workshops.

Crossley Brothers, Ltd., Openshaw, Manchester.—Publications Nos. 1240B, 1313A, 1346 and 1356 dealing, respectively, with vertical compressorless Diesel engines, enclosed horizontal oil engines, the installation at a Yorkshire woollen mill, and Messrs. Douglas Fraser's installation.

Mullard Wireless Service Co., Ltd., Mullard House, Charing Cross Road, London, W.C.2.—An effective leaflet entitled "Nothing but the Truth," giving full details of Mullard "Pure Music" speakers.

Falk, Stadelmann & Co., Ltd., 83-93, Farringdon Road, London, E.C.1.—Catalogue No. 640, on modern shop-window lighting, and a revised price list of "Hitest" cables, "Efesca" flexible cords and bell wires.

Liverpool Electric Cable Co., Ltd., Linacre Lane, Bootle, Liverpool.—A leaflet describing the company's latest development in non-inflammable and self-extinguishing cable, manufactured under the name of "Lewbestite."

Veritys, Ltd., Aston, Birmingham.—List No. 1073, dealing with industrial reflectors and lanterns, and street, ship, train, shop and commercial lighting fittings. Also lists Nos. 1088/30 and 1089/30, giving particulars of the latest types of "Maxlume" electric fires.

Electric Resistance Furnace Co., Ltd., 17, Victoria Street, London, S.W.1.—A supplementary pottery number of the "Resistance Furnace."

Maurice Bobin, 15, Farringdon Avenue, London, E.C.—Catalogues of "Aladin" and "Fiat Lux" French portable domestic lamps, for which M. Bobin is the sole agent in this country.

The Consolidated Pneumatic Tool Co., Ltd., 170, Piccadilly, London, W.1.—Catalogue (No. 16) of portable electric tools for all purposes.

Crompton Parkinson, Ltd., Guiseley, Leeds.—An attractive illustrated price list of electric lamps.

Philips Lamps, Ltd., 145, Charing Cross Road, London, W.C.2.—Publication No. 231X dealing with "Metalix" pearl and precious stone testing apparatus.

Premier Electric Heaters, Ltd., Keeley Street and St. Andrews Road, Birmingham.—List No. 138, giving particulars of "Premier" electric fires and other domestic electrical appliances.

Wheeler & Esser, 7, Upper Marylebone Street, Great Portland Street, London, W.1.—A price list of electric candle tubes.

Venner Time Switches, Ltd., 45, Horseferry Road, Westminster, London, S.W.1.—Leaflet describing the "G.P.O. Power" and general types of relays.

The Typerlite Company, 86, Cannon Street, London, E.C.4. —An illustrated catalogue showing some applications of the "Typerlite" fittings.

L. G. Hawkins & Co., Ltd., 30-35, Drury Lane, London, W.C.2.—The October issue of "The Link" containing articles on shop-window, commercial and interior lighting systems, protective gear, &c. Also well-illustrated booklets on Pye radio receivers and "Magicoal" electric fires.

Calendar blotters for October have been received from Pope's Electric Lamp Co., Ltd., 5, Arthur Street, New Oxford Street, London, W.C.2; Mavor & Coulson, 47, Broad Street, Glasgow, S.E.; and S. Rogers & Co., Ltd., 15, Fitzroy Street, London, W.1.

Trade Announcements.

Messrs. Jackson Boilers, Ltd., have removed their business to larger premises at Vulcan Works, Shafton Lane, Holbeck, Leeds. (Telephone 22456.)

The Bristol office of the Metropolitan-Vickers Electrical Co., Ltd., has been removed to 22, Victoria Street (Telephone No. 6860/1; telegrams. "Multiphase, Bristol"). The "Cosmos" lamp depôt is at the same address.

The London office address of the Macintosh Cable Co., Ltd., has been changed to Bank Buildings, 20, Kingsway, W.C. (telephone: Holborn 3787/8). The London sales office remains at Amberley House, Norfolk Street, Strand, W.C.

Messrs. David Brown & Sons (Huddersfield), Ltd., announce their amalgamation with P. R. Jackson & Co., Ltd., Salford. The policy of the joint companies will be to operate entirely independently as regards the execution of orders, but design will be standardised and the technical and research work will be available to the joint concerns.

Messrs. Wallis & Watson (proprietors Green & Smith, Ltd.), electrical engineers and contractors, have removed their electrical showroom and offices to Bardon Chambers, King Street, Leeds.

The address of the Manor Electric Oven & Fire Co. is now 7, Sutton Street, Charing Cross Road, W.1.

Recent Contracts.

Among the transformer orders which have recently been received by Messrs. Johnson & Phillips, Ltd., are the following:—Two 1,250-kVA, 3-phase, for the Auckland Electric Power Board, New Zealand; two 550-kVA, 3-phase, for a Chinese power plant; one 1,000-kVA, 3-phase, for a Scottish colliery; 30 100-kVA, single-phase, for Christchurch City Council, New Zealand; one 1,000-kVA, 3-phase, for the City of Salford; 41 distribution transformers from 10-150 kVA, for the Thames Valley Electric Power Board, New Zealand; two 500-kVA, 3-phase, for a London supply company; and four 417-kVA, single-phase, for the Kanieri Electric Co., New Zealand.

The Alton Battery Co., Ltd., has received an important order to supply the batteries required for the developments in automatic telephony which are now taking place over the whole of the Johannesburg, South Africa, area. The batteries cover a wide range of capacities, the largest being of 4,524 Ah.

Other important contracts recently placed with the company include three batteries for the Hull Corporation Telephone Department, the renewal of batteries at Torquay, Oxford, and Tunbridge Wells telephone exchanges, and the partial renewal of power station batteries at the Shoreditch, Southwark and Wisbech electricity works.

It is reported that the Newcastle-upon-Tyne Electric Supply Co., Ltd., has placed orders for plant valued at nearly £500,000 for the new Dunston power station. The bulk of this total represents the value of boiler plant, orders for which have been placed with Clarke, Chapman & Co., Ltd. and Babcock and Wilcox, Ltd. Condensing plant and auxiliaries are being supplied by Richardsons, Westgarth & Co., Ltd.

Control equipments numbering 160 for new motor and trailer cars of the London Electric Railways are to be supplied by the British Thomson-Houston Co., Ltd., Rugby. All the latest improvements are embodied in the design of the new equipments, which include circuit breakers, reversers, master controllers, cut-out switches, contactor control gear, relays, switchboards, &c. In January, 1928, the B.T.-H. Co. supplied 561 control equipments to the "Underground" companies.

The Hart Accumulator Co., Ltd., recently supplied a "Hart" battery consisting of 116 "BT.9" type cells for the emergency electric lighting of the New Victoria Cinema, Bradford, which is reputed to possess a larger seating capacity than any other cinema in the provinces.

Book Notices.

"The Annuaire Téléphonique International (A.T.I.)"—The second edition of this international telephone directory contains the names of more than 50,000 firms in 2,718 towns in 38 countries; the first edition published in 1929 contained only 12,000 entries representing 1,485 towns in 27 different countries. Besides being printed in English, French and German, the Spanish language has now been partly introduced. Only business firms interested in international trade are included, and the directory therefore forms an extremely useful and up-to-date combination of an international telephone book and a trade guide. Further particulars of this publication may be obtained from the official representatives in this country:—Messrs. Rassey Bros., Bevois House, 28, Basinghall Street, E.C.2.

"Costing and Price-fixing," by J. M. Scott Maxwell. Pp. xii+211; figs. 21. London: Sir Isaac Pitman & Sons, Ltd. Price 6s. net.

"The Conduction of Electricity Through Gases," by Dr. K. G. Emeléus. Pp. x+94; figs. 37. London: Methuen and Co., Ltd. Price 2s. 6d. net.

Messrs. Chapman & Hall, Ltd., have sent us their Autumn List which includes the titles of, and notes on, a number of technical works.

For Sale.

Stocks of wireless and electrical goods of various companies now in liquidation will be sold by auction at 13, High Holborn, W.C.1, on November 5th, 6th, 12th and 13th by Mr. Henry J. Shaw, auctioneer, of 129, Newington Causeway, S.E.1.

Harwich Electricity Department has for sale a motor-generator, a switchboard and batteries.

(See our advertisement pages to-day.)

Social Event.

G.E.C. Swimming Gala.—The G.E.C. Social and Athletic Club recently held its annual swimming gala at the Holborn Baths, when several important events were decided. Six London establishments of the G.E.C. competed for the Gamage Cups, presented by Mr. and Mrs. Leslie Gamage. These were won by Magnet House, Head Office and the G.E.C. Research Laboratories' teams, respectively.

The Buenos Aires Exhibition.

The London office of the British Empire Trade Exhibition, Buenos Aires, 1931, has received a cable from Buenos Aires stating that the new Argentine Government has consented to issue an official decree giving protection to all patents, trade marks, &c., unregistered in Argentina for a period of six months and covering the duration of the Exhibition. Patents and trade marks belonging to exhibitors have so often been the subject of piracy by unscrupulous persons, prior to such exhibitions, that the value to exhibitors of this concession by the Argentine Government is considerable.

Glass Works Stoppage.

As a protest against delay on the part of the Home Office in renewing its permission for a German "key" worker to reside in this country, the works of Messrs. Hailwood and Ackroyd, Ltd., Morley, Yorks., were closed down on September 30th and October 1st. From copies of the correspondence passing between the Home Office and the company, which we have received from the latter, we judge that although the company applied for an extension of the permit on August 30th this was not received until September 29th.

A Report upon Bulgaria.

The Department of Overseas Trade has published (through the Stationery Office, 2s. net) a report on economic conditions in Bulgaria by Mr. S. Harrison, O.B.E., Acting British Consul at Sofia. In the course of this the author states that at the end of 1928 Bulgaria possessed generating plant totalling 82,703 kW, the year's output being 65,316,787 kWh; a further 35,175 kVA of plant was in course of construction. The bulk of the output was from hydro-electric stations of which there were 21 with a total capacity of 37,156 kW. Nearly half of the electricity generated came from two large stations. It is expected that the Vutcha Water Syndicate's 14,000-kW hydro-electric works on the Kritchim will be completed by the end of next year. The Syndicate is doubling the capacity of its existing 2,400-kW "thermal" station. The Skoda Works has completed a new station at the State coal mines, Pernik. Its present capacity is 8,000 kW, but it is ultimately to be raised to 32,000 kW. Mr. Harrison mentions a number of important lines in which there is room for expansion of the British share, and he says, *inter alia*, that the supply of bare and insulated copper wire and electrical appliances and fittings is worthy of more serious attention on the part of British exporters. It is stated that German or French should generally be used in correspondence and catalogues, and dimensions and weights should be in the metric system. Prices should be quoted c.i.f. to one of the Black Sea ports. The appointment of agents is a matter needing great care and preliminary inquiry, and the

commercial status of prospective buyers should be vouched for by more than one reference. Tenderers for State and other public contracts are advised to adhere closely to the conditions laid down as otherwise tenders will be disqualified and the trouble and expense of preparing them wasted. This important class of business is mainly in the hands of Continental competitors.

The Timber Market.

Our Timber Trade Correspondent reports that the imported building woods trade, which for so long has been weak, has strengthened a little in tone during the past month. This is due to the fact that the Russian supplies to this country for 1931 will be handled exclusively by a British syndicate of importers, who also will take over all unsold stocks in this country in Russian shippers' hands at the close of this year. The market will consequently come nearer to stability than has been experienced this year. The 1930 and 1931 shipments from Russia will not be so large as was at first anticipated. In the hardwood section of the trade, mahogany logs have been firmer in value at Liverpool sales, stocks being on the small side; teak is strong in price, whilst other hard and fancy woods, including those for home and overseas production, are steady. American sawn woods continue weak. Plywood imports have been comparatively small, which will help to strengthen a weak market.

Prices of Materials.

Messrs. Edward Till & Co. report, October 7th: India-rubber, Para fine: no change.

Messrs. James & Shakespeare report, October 7th: Copper bars (best selected), sheet and rod: £75 (£2 dec.). English pig lead: £17 10s. (15s. dec.).

Messrs. F. Smith & Co. report, October 7th: Copper (electrolytic) bars, £47 10s. (£1 10s. dec.); ditto, ditto, sheets: no change; ditto, ditto, wire rods, £57 10s. (£1 10s. dec.); h.c. wire 7 7/16d. (3/16d. dec.); silicium bronze wire, 9¼d. (¼d. dec.).

Messrs. James Forster & Co., reporting on October 4th, stated that a fresh break in values was seen on Monday last week, and prices finally settled down about 20s. lower on the day. After that, renewed support kept the market steady but the tone at the close was very uncertain. Demand from consumers continues disappointingly slow in spite of the fall, while arrivals this month promise to be on the full side, so that it is difficult to see how producers will be able to dispose of their lead without adding to their already substantial stocks.

Lighting and Power Notes.

Australia.—Victoria.—For the year ended June 30th the Victorian Electricity Commission made a profit of £5,266, as compared with £4,614 for the previous year, these figures including the supply of electricity and briquetting. The total revenue was £1,904,971 and expenditure £1,899,705. The electrical energy sold amounted to 396,227,217 kWh, an increase of 39,633,493 kWh as compared with 1928-9. The maximum demand on the system was 97,200 kW, an increase of 6,200 kW. Stringency of loan funds prevented many rural extensions, but eight new centres were connected during the year, the total number now receiving supply being 149.

Electricity Extensions at Clarence River.—Application has been made by the Clarence River County Council for sanction to a loan of £30,000 for electricity supply extensions.

Sydney.—It is possible that Mr. Forbes Mackay, general manager of the Sydney Municipal Electricity Department, will become chairman of an independent electricity board in accordance with a plan to place the city electricity undertaking under a separate board of management with a view to greater efficiency. The proposed board would have a capital of £20,000,000, and it is understood that the City Council would still control the expenditure.

Birkenhead.—Loan Sanctioned.—The Corporation Electricity Committee has obtained sanction to a loan of £25,000 for mains, services, and sub-station equipment.

Bristol.—Year's Working.—The accounts of the Corporation electricity undertaking (engineer and general manager: Mr. H. Faraday Proctor) for the year ended March 31st last show an increase in the total revenue from £572,439 to £615,972. Working expenses amounted to £328,235, as against £279,529 in the preceding year, leaving a gross profit of £287,737 (£292,910). To the gross profit was added an unemployment grant (£4,788), interest on expenditure on culverts, &c., at Portishead (£16,212) and income-tax deducted from interest (£22,089), making a total of £330,826 available. Interest on loans absorbed £177,072, loan redemption and sinking fund contributions £113,684 and income tax £32,684, leaving a net surplus of £7,386. This surplus is £58,488 lower than that of 1928-29, the decrease being due largely to a rise of £52,881 in loan interest. Expenditure on capital account during the year amounted to £1,081,457, of which approximately three-quarters was for machinery, buildings, cables, &c., in connection with the Portishead works. The total now spent on the undertaking stands at £5,183,531. Sales of electricity increased from 93,441,031 to 96,633,600 kWh and the maximum load from 40,220 to 45,395 kVA. The average income per kWh sold rose from 1.37d. to 1.443d. The Portishead station was first used for transmitting energy to Bristol on June 13th, 1929, but was not available for general use until the latter portion of the year. Since the termination of the year under review the change-over to the standard three-phase system of supply has been completed and the single-phase system has been entirely dispensed with.

Burnley.—Change-over.—The Electricity Commissioners have sanctioned the borrowing of £45,775, part of the estimated cost of £47,075 for the changing-over of the supply from d.c. to a.c.

Canada.—Pend D'Oreille Power Development Sanctioned.—The application of the West Kootenay Power and Light Co., Ltd., to the Provincial Water Board for authority to develop hydro-electric energy on the Pend d'Oreille River has now been approved by the Controller of Water Rights. The licence granted authorises the erection of two dams, one at Sevenmile Creek and the other at Cedar Creek. The company is thus assured of the right to develop hydro-electric power along the entire stretch of the Pend d'Oreille River from the United States boundary to the point at which it joins the Columbia River. The execution of the project would enable the company to develop 175,000 h.p., although the actual installation of turbines and generator equipment will probably be considerably larger.

Continental.—Russia.—A scheme is reported to have been prepared by the Soviet authorities for the construction of two power stations on the Volga in the vicinity of Samara having a combined capacity of 900,000 kW and being capable of producing 5,000,000,000 kWh per annum.

France.—The Compagnie Lorraine d'Electricité has decided to double the capacity of its generating station at Vincey, increasing it first from 40,000 to 60,000 kW and then to 80,000 kW, by the installation of two 20,000-kW turbo-generators. A new 20,000-kW set is also to be added to the company's power station at Nancy, bringing the capacity up to 40,000 kW.

Poland.—A Swiss financing group, which includes the Motor Columbus Co., of Baden, is interested in a scheme for extending electricity supply facilities throughout Western Poland.

Spain.—Good progress is now being made with the establishment of a hydro-electric station, commenced in 1927, to utilise certain falls on the River Alberche, about 47 miles from Madrid. It is estimated that the plant will be able to supply 425 million kWh per annum.

Darlington.—Electricity Progress.—Addressing a recent meeting of the Town Council, the chairman of the Electricity Committee said the electricity output during the year amounted to 26½ million kWh, an increase of 3½ million kWh on the output of any previous year and nearly twice as much as four years ago. Owing to the reduction in charges, the revenue, which amounted to about £83,000, showed no increase, and the surplus profit was reduced to £6,300. The working costs were reduced from 0.40d. in the previous year to 0.38d. During the year the average charge per kWh was 2d. for lighting and 0.55d. for heating and power, as compared with 2.3d. and 0.62d. respectively for the previous year. With regard to the Corporation's electricity showrooms the results obtained during the first full year were very satisfactory. The total sales amounted to £6,807 and appliances to the value of £1,067 were let out on hire. There were over 900 customers with hire-purchase appliances and the cookery demonstrations given at the showrooms had been largely attended.

Dartford.—Price Reductions.—The Urban District Council Electricity Committee recommends the following reductions in electricity charges: Domestic tariff; 10s. per room per annum, plus ¾d. per kWh. Domestic prepayment supplies: From 6d. to 5½d. per kWh.

East Ham.—Loans Sanctioned.—The Corporation Electricity Committee has obtained sanction to the following loans:—£4,000, for Plashet sub-station; £6,946, for new mains to Plashet sub-station; £2,641, for new feeder mains from Church Road sub-station to Branckaster Road; and £7,423, for cable extensions.

Edinburgh.—Electrical Installations in Tenements.—The Corporation Electricity Committee has decided to recommend that additional facilities be given for the installation of electricity in tenements in the city. The decision is expected to lead to a considerable increase in the electric lighting installations in the city.

Glasgow.—Mains Extension.—The Corporation Electricity Committee recommends that distributing mains be laid at a cost of £3,634.

Gloucester.—Cookers for Hire.—The City Council has adopted a recommendation by the Electricity Supply Committee to purchase two types of electric cookers to be let out on hire. It was stated at the meeting of the Council that local contractors were prepared to sell cookers, but not to hire them.

Gower.—Proposed Bulk Supply from Swansea.—Mr. D. R. Grenfell, M.P., has written to the Gower Rural District Council stating that he has taken up the question with various Government Departments of obtaining financial aid towards obtaining for the Gower peninsula a supply of electricity in bulk from the Swansea Corporation. It is suggested that the scheme would involve an expenditure of £50,000. Mr. J. W. Burr, the Swansea borough electrical engineer, has stated that if the Rural District Council obtains a Provisional Order the Swansea Corporation may be prepared to supply on the usual bulk supply terms.

Guildford.—Extensions.—At a meeting of the Corporation Electricity Committee held recently the borough electrical engineer reported that the work in connection with the extension of the electricity mains to Peaslake and district was in hand, and he hoped to have the work completed by the end of this month. A large number of applications for supply in this district have been received, and further applications are still coming in.

Loans Sanctioned.—Sanction has been received by the Electricity Committee to the borrowing of the following sums for mains extensions: Albury Heath, Brook, Little London, Farley Green and Peaslake, £11,391; Guildown area, £2,418.

Hull.—Street-lighting Improvements.—The Corporation Works Committee has adopted a recommendation of the city engineer for improved lighting by electricity in several streets.

Ilford.—Hire and Hire-purchase Schemes.—Up to March 31st, 1930, the Corporation Electricity Department had spent £51,500 on hire and hire-purchase schemes. Of this sum £19,000 was for the hire of electrical installations, £24,500 for the hire of apparatus, £5,000 for the hire-purchase of electrical installations, and £3,000 for the hire-purchase of apparatus.

Irish Free State.—Millstreet, Co. Cork.—The Cork County Board of Health is taking steps to have electricity installed in the town of Millstreet. Application is being made to the Minister of Local Government for an Order conferring on the Board urban powers in respect of Millstreet, for the purpose of enabling it to light the streets of the town. It is intended to obtain a supply of electricity from the Electricity Supply Board.

The Shannon Scheme.—A further development of the Shannon electricity scheme is forecast in connection with Lough Allan. For the past few weeks engineers have been busily employed taking the water levels with a view to raising embankments round the Lough to the height of some four or five feet. A permanent barrier will be run across a portion of the bottom end of the Lough, fitted with sluices to regulate the flow of water near Drumshambo, and the level of the Shannon will be lowered. A canal will regulate the water level at the other end.

Japan.—New Power Stations.—Official sanction is likely to be forthcoming shortly to the erection of a 40,000-kW steam power station by the Yamagata Prefectural Office. The erection of a 20,000-kW steam power station is also projected during the next fiscal year by the S.M.R.

Leicester.—Loan.—The Corporation Electricity Committee is applying for sanction to a loan of £50,000 for sub-station requirements.

Liverpool.—Loans Sanctioned.—Sanction has been received by the Corporation Electric Power and Lighting Committee to the following loans:—£13,127 for new plant and foundations at the Lister Drive power station, and £300,000 for unspecified mains extensions.

Tariff Alterations.—A concession has been made to a section of consumers using electricity for thermal-storage water heating. One part of the rateable value scale which hitherto has applied only to private dwellings is also being extended to business premises.

London.—New Fulham Station.—Plans for the erection of a new 318,000-kW generating station were approved by the Fulham Borough Council on October 1st. It is to be situated in South-West London on the opposite (north) bank of the River Thames to the Battersea station now being built for the London Power Co., which will be of 360,000 kW when fully developed. The new Fulham station will cost £5,530,000, including £400,000 for the 10-acre site and "trade displacement," and the first portion of the plant will be of 120,000-kW capacity. Alderman Flew is reported to have said that it was first thought that the new station would be built at Chiswick, but it was agreed that the Fulham site was more suitable.

Battersea.—The Borough Council Electricity Committee has received sanction to the borrowing of £8,500 of the £9,559 required for plant foundations, connections, &c., in respect of the extensions of plant at the Council's generating station.

Hackney.—The Borough Council has received sanction to loans of £25,000 for services and £25,000 for house meters.

Lytham-St.-Annes.—Year's Working.—The accounts of the Corporation Electricity Department (engineer: Mr. J. C. Fairchild) for the year ended March 31st last record a total revenue of £64,317, a working expenditure of £38,319, and a gross profit of £25,998. Figures for the previous year were: Income, £62,319; working expenses, £36,870; gross profit, £25,448. From the gross profit had to be deducted loan interest (£11,057), sinking fund contributions (£12,013) and bank interest (£1,836), which left a net surplus of £1,092, as against £2,485 in the preceding year. Capital expenditure during the year amounted to £28,641 and included £24,339 for mains and services; the total now spent on the undertaking is £362,355. Sales of electricity increased from 7,227,621 to 7,382,647 kWh, in spite of the decline in the quantity consumed for traction purposes from 723,767 to 634,455 kWh; the maximum demand recorded reached 3,434 kW. The total number of consumers at the end of the year stood at 11,416, an increase of 1,044 during the year. A supply to Warton and Freckleton was inaugurated on June 18th last year and good progress was made with the changing-over of consumers from d.c. to a.c.

Bulk Supply from Preston.—The Town Council is terminating its agreement for a bulk supply of electricity from Blackpool Corporation, and has approved an agreement for a supply in bulk from Preston.

Marple.—Mains Extensions.—The Urban District Council has received sanction to a loan of £5,540 for mains extensions.

Mexico.—Water-power Resources.—Mexico is credited with water-power resources totalling 6,000,000 h.p., of which up to 1927 only 333,000 h.p. had been utilised. Of this total, 270,000 h.p. was generated by central power stations which sold energy, 30,000 h.p. by private plants serving other manufacturing and agricultural enterprises, and 8,000 h.p. by private plants attached to mining companies. This capacity was nearly double that of the steam-operated electrical plants in the country, which totalled 193,000 h.p., made up as follows: Central stations, 98,000 h.p.; installed by mining companies, 68,000 h.p.; the textile industry, 5,000 h.p.; other industries, 22,000 h.p.

Nantwich.—Commissioners to be Consulted.—The Rural District Council has received a letter from Electricity Distribution of North Wales and District, Ltd., stating that owing to the large capital expenditure entailed it could not consider the extension of transmission mains from Nantwich or Audlem. The Council has decided, therefore, to lay the whole position before the Electricity Commissioners to ascertain whether they can take any steps to expedite a supply of electricity to the district.

New Zealand.—The Arapuni Hydro-electric Scheme.—The Minister of Works states that Professor Hornell's investigations of the Arapuni hydro-electric scheme indicate that remedial measures are practicable. The Government has asked Professor Hornell to investigate and report on other main hydro-electric schemes on both islands.—*Reuter* (Wellington).

Paisley.—Bulk Supply Inquiry.—Sir Andrew Duncan, chairman, and Sir Archibald Page, chief engineer of the Central Electricity Board, visited Paisley on October 1st, when a private conference was held in the municipal buildings respecting changes brought about by the establishment in Paisley of a Central Electricity Board sub-station. Sir Andrew Duncan presided and those represented at the conference were the Clyde Valley Electrical Power Co., the Greenock Corporation, the Ayrshire Electricity Board, and the Paisley Corporation. It is understood that the subject under discussion had reference to the present system of bulk supplies from Greenock and Kilmarnock, and the possibility of a new arrangement being arrived at in connection with future supplies from the grid.

Retford.—Bulk Supply.—The Town Council has decided to take a bulk supply of electricity, to supplement the local supply, from the Derby and Notts. Electric Power Co.

Rotherham.—Cable Extensions.—The Corporation Electricity Committee has received sanction to a loan of £7,883 for extending the h.p. cables to Swinton.

Sheffield.—Loans Sanctioned.—The Corporation Electricity Committee has obtained sanction to the borrowing of £9,055 for mains, and £453 for sub-station equipment on the Shiregreen estate.

Stone (Staffs.).—Extensions.—The Urban District Council has decided to extend its area of supply to Rough Close, Meir Heath, Upper Barlaston, and Strongford Bridge. Specifications for the work are to be prepared at once with a view to obtaining tenders.

Straits Settlements.—Singapore.—We have received from Mr. S. S. Wilson, the municipal electrical engineer, a copy of his annual report on the working of the electricity undertaking for the year ended December 31st last. The total revenue amounted to $2,385,875 (dollar=2s. 4d.), and there was a working expenditure of $861,669, leaving a gross profit of $1,524,205. After deducting $740,778 for loan charges, $80,101 for renewals, and $500,384 for contribution to capital outlay out of revenue, there was a net surplus of $202,943. Electricity sold for all purposes amounted to 22,668,716 kWh, an increase of 5,499,144 kWh over the previous year; the maximum load increased from 7,000 to 8,200 kW. For the whole supply the average price obtained fell from 12.482 cents to 10.371 cents.

York.—LOANS SANCTIONED.—The Corporation Electricity Committee has obtained sanction for the following loans:—Site and building, Knapton sub-station, £575; domestic apparatus, £15,441; house-wiring installations, £2,702.

EXTENSION OF ASSISTED WIRING SCHEME.—The Electricity Committee has decided to extend its system of assisted and deferred payments for house wiring to rural areas, subject to the period of repayment being restricted to three years.

Tramway and Railway Notes.

Australia.—FREMANTLE.—The Tramways Board has decided to apply for sanction to loans of £30,000 for sub-stations and equipment and £5,000 for additional cars.

Continental.—SWEDEN.—The Swedish State Railways, in submitting their requests for Budget allowances next year, say that the full inquiry into the question of electrifying the Stockholm-Malmoe-Traelleborgs main line, which has been decided upon in principle by the Riksdag, will not be completed until November. Meanwhile, however, it may be stated that about kr. 26,000,000 will probably be required for the period up to June 30th, 1932.—*Reuter's Trade Service* (Stockholm).

SPAIN.—According to *Modern Transport*, the directors of the railway between Bilbao and Portugalete are considering the purchase of material for electrifying the line.

FINLAND.—The committee appointed by the Finnish Government to investigate the question of the electrification of the railways has now issued its report. The committee finds that under the influence of the present critical economic times, the work of conversion would not be realisable owing to the large expenditure which would be involved. It is calculated for example that a sum of between 70 and 80 million Finnish marks would be required for the electrification of the Helsingfors-Riihmaki and Helsingfors-Karis lines alone.

Dover.—EXTENSION OF TIME.—The Minister of Transport has extended the time limited for the completion of the tramways authorised by the Dover, St. Margaret's and Martin Mill Light Railways Order, 1909, until October 11th, 1931.

Ilford.—YEAR'S WORKING.—We have received from Mr. L. E. Harvey, manager and engineer of the Corporation Tramways Department, a copy of his report together with a statement of accounts for the year ended March 31st last. The total revenue amounted to £79,169 and there was a working expenditure of £58,010, leaving a gross profit of £21,159. The corresponding figures for the preceding year were: Income, £77,456; working expenses, £58,994; gross profit, £18,462. After providing for capital and other charges, there was a net surplus of £8,840, as compared with £7,725 in 1928-29. The number of passengers carried increased from 15,880,953 to 16,395,883 and the car miles run from 1,111,686 to 1,128,303. The average revenue per car mile fell from 16.722d. to 16.710d. During the year a fresh agreement was signed with the Barking Urban District Council covering the lease of its line for a further 20 years. The track is now being reconstructed at a cost of approximately £20,800, and this will mean a very large increased rent of the line to cover charges amounting to approximately £1,600 per annum; in addition the existing sinking fund and interest charges on the original track will have to be paid till they expire in September, 1936. These sums will be debited to the revenue account, and will consequently have an adverse effect on the net surplus for some years to come.

Japan.—NEW ELECTRIC RAILWAY.—A scheme is under consideration for the construction of an electric railway from Mitaki, the terminus of the Ome railway, to Hikawa, a distance of about eleven miles.

Leeds.—NEW TRAMCARS.—The Corporation Tramways Committee has obtained sanction to the borrowing of £200,000 in respect of new tramway cars.

PARCEL CARRYING SERVICE.—The Tramways Department, which for some time past has had an arrangement with tramway authorities of other towns for the joint working of a parcel collection and delivery service over most of the West Riding, commenced at the beginning of this month an extended parcel service as far afield as Manchester and Liverpool, by similar arrangements.

L.N.E. Railway.—According to *The Times*, the London and North-Eastern Railway has decided to adopt generally the electric colour-light system of signalling. The entire signalling system at King's Cross is about to be converted, and part of the equipment will include 60 long-range colour lights and 90 short-range shunting lights. The new type of signal has been installed between Leicester and Nottingham and at Sunderland and Escrick. An electrical system has been operated for some time on the line from Marylebone to Rickmansworth.

London.—TUBE EXTENSION.—The first section of the Underground Railway's £3,000,000 scheme for the extension of the Piccadilly Tube from Hammersmith to Northfields is now in progress. The contractors for this part of the work, which involves the expenditure of nearly £180,000, are Messrs. Balfour, Beatty & Co., Ltd. The work is expected to take 18 months, and, with the extension from Finsbury Park to Cockfosters, will provide employment for about 20,000 men.

Southern Railway.—BREAKDOWN.—The failure of an electric cable near Spa Road, Bermondsey, shortly after 7 p.m. on Monday last caused a complete breakdown of the electric signalling system between Charing Cross, London Bridge, Cannon Street, and the suburbs. Emergency services were run from Holborn and St. Paul's stations and the normal service was not resumed until about 9-30 p.m.

Walsall.—CORPORATION TAKES OVER TRAMWAY SYSTEM.—On October 1st the Corporation took over from the South Staffordshire Tramways Co. the sections of the tramway system between Walsall, Wednesbury and Darlaston. Reduced fares and penny stages similar to those already in operation on other sections of the Corporation's system have been introduced.

Telegraph and Telephone Notes.

Blackpool.—AUTOMATIC TELEPHONY.—There was a large attendance of prominent citizens on October 1st when Mr. R. Bell, Post Office Surveyor, North-Western District, said the department's faith in Blackpool's future might be gauged from the fact that it had provided in the South Shore building space for 3,400 subscribers' lines with means to extend and cater for 6,000. At North Shore the comparable numbers were 1,700 and 4,000. At the head office the building would hold equipment for 12,000 subscribers, and give the necessary manual service for trunks and junctions. The total subscribers provided for were 22,000 and the present number was 3,601.

Germany.—NEW TELEPHONE CABLE.—By means of a submarine telephone cable, which has recently been laid between Stralsund, Pomerania, Prussia, and the Swedish Coast, it will be possible for eighty-four conversations and one broadcast music relay to take place simultaneously. The cable is seventy-five miles long, and was manufactured and laid by a Cologne company. It is claimed that the eighty-five circuits contained in the cable is the highest number yet employed in a single sea cable.—*Reuter* (Cologne).

International Telephony.—BELGIUM.—Owing to the congestion on the existing lines, a proposal to provide another telephone cable between Brussels and Paris is under consideration. It is stated that over 1,300 conversations per day are at present taking place between the two cities.

ENGLAND.—The use of the telephone service between Britain and other countries continues to expand. International calls dealt with by the British postal system in May last (the latest figures available) numbered 99,381, of which 48,354 were outgoing and 51,027 were incoming. These figures represented increases of 5,586 and 5,360 calls, respectively, over those in May, 1929, a total average increase of 353 a day.

Italy.—NEW TELEPHONE CABLES.—The Societa Italiana Reti Telefoniche Interurbane, of Milan, which is associated with the Siemens & Halske Co., of Berlin, and the International Standard Electric Corporation, has secured a contract from the Italian Government for the supply and laying of telephone cables between Naples and Bari with a branch from Auletta to Messina and Palermo, Sicily.

Mexico.—NEW WIRELESS INSTALLATION.—Government engineers are completing a new 100-watt wireless station at Bacochibampo, a few miles from the port of Guaymas. The equipment largely supplied from Germany, includes a 6-h.p. engine to generate power. The wavelength has not yet been decided, but it will be suitable for communication with Mexico City, 1,280 miles away, and there will be direct communication with the Santa Rosalia and La Paz stations in Lower California.—*Reuter's Trade Service* (Mexico City).

The Telephone Service.—EXPANSION.—The total number of telephone stations in the Post Office system at July 31st, 1930, was 1,916,058, a net increase of 4,231 over the total for the previous month. Of that total, 688,330 were in London and 1,227,728 in the provinces. Call office stations, including kiosks, numbered 6,269 in London and 26,238 in the provinces, while 1,803 rural railway stations were connected with the telephone system. Inland trunk calls dealt with in May, 1930, totalled 10,550,729, an increase of 375,447, or 3.7 per cent. over the May, 1929, figure.

Uruguay.—TELEPHONY IN MONTEVIDEO.—The Government has appointed a Commission of engineers to draft specifications and consider tenders for the installation of a telephone system at Montevideo and towns in the interior. Fresh tenders are being invited, those previously submitted having been rejected.—*Reuter's Trade Service* (Montevideo).

Radio Notes.

Finland.—Licences.—Registered listeners number about 100,000. In addition to Lahti (40 kW) and Helsingfors (10 kW), there are four small stations. The State collects the licence fees, part of which it retains for the upkeep of the transmitters, which is the business of the State. The remainder of the revenue goes to the limited company that provides the programmes, which was formed by the co-operation of societies having educational aims.

Foreign Relays.—Cost.—The cost of chartering telephone circuits across Europe can only be justified if thousands of home folk desire to hear the best music imperfectly reproduced in preference to the next best perfectly reproduced, says the *Wireless World*, which suggests that if the B.B.C. could have arranged elaborate relays six years ago there might have been a demand for them, but it is doubtful whether receivers and land lines were equal to the task. The irony of the present situation is the fact that the improvement of Continental land lines and repeaters come too late. The majority of listeners interested in Continental programmes can pick them up direct. It is suggested that the B.B.C. may shortly alter its foreign relays policy, deciding to use the Continental land lines only for events of exceptional importance; efforts to relay music will probably be abandoned.

Irish Free State.—New Station.—A contract for the erection of a high-power broadcasting station in the centre of Ireland has been placed with Marconi's Wireless Telegraph Company, Ltd., by the Free State Department of Posts and Telegraphs, says *The Times*. The power of the station will be 60 kW, and it is expected that the station will be erected at Athlone or Birr.

Relay Exchange.—Chelmsford.—The Corporation Highways Committee has received from Broadcast Relay Service, Ltd., an application to establish a broadcast relay exchange in Chelmsford, and asking the Council to grant permission to cross roads with overhead wires, the height of which would be 24 ft. above any road and 30 ft. above county roads, the wires to be erected to the satisfaction of the borough engineer and a return submitted each month of all road crossings, showing positions, lengths, and heights of wires, together with a scale map. An indemnity agreement would be made, covered by insurance, providing every protection against claims from any cause whatsoever. The Council would receive an annual fee at the rate of £250 per 1,000 subscribers, with a minimum annual fee of £250; should it be so desired, the company would pay the expenses of a committee to inspect the system in operation at Clacton-on-Sea. The service would be installed free, the only charge being a rental of 1s. 6d. per week for maintenance, and it would be supplied free to the blind. The Corporation Highways Committee recommended that a sub-committee be appointed to inspect the system in operation at Clacton-on-Sea.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the Electrical Review containing the advertisement is given in parentheses below.

Contracts Open.

Australia.—Melbourne.—Posts and Telegraphs Department. November 18th. Telephone receivers, ebonite earpieces, &c. (A.X. 10183.)*

October 28th. Radio terminal telephone equipment. (A.X. 10288.)*

November 25th. Motor-generator sets. (A.X. 10184.)*

January 6th, 1931. Submarine cable (A.X. 10309.)*

Belfast.—October 15th. Harbour Commissioners. Three electrically-driven pumps at Clarendon Graving Docks. Specifications, &c., from Mr. W. Y. Chamberlain, acting chief engineer, Harbour Office, Belfast. Tenders to Mr. M. J. Watkins, general manager and secretary, Harbour Office, Belfast.

Belgium.—Ixelles.—October 15th. 1,200 5-amp., 220-V. electricity meters. Particulars (Cahier des Charges) for 6 fr. 75 c. (approximately 10d.) from Service de l'Electricité, 20, Rue d'Alsace-Lorraine, Ixelles. Tenders to Hotel Communal.

Bradford.—November 8th. Tramways Committee. Twelve months' supply of stores, including electrical fittings for tramcars (Sch. No. 3), insulating material and delivery hose (No. 4), insulated bolts, strains and copper controller contacts (No. 7). Schedules numbered as above from tramway general manager, 11, Forster Square.

Edinburgh.—October 13th. Corporation Public Health Department. Supplies for six months from November 16th, including electrical fittings. Forms from Public Health Chambers, Johnston Terrace. Tenders to town clerk.

India.—New Delhi.—October 27th. India Store Department. Electricity meters. (A.X. 10287.)*

Irish Free State.—Dublin.—October 23rd. Irish Press, Ltd. Supply and installation of electrical equipment at company's offices at 12-13, Burgh Quay. (See this issue.)

Leyton.—October 31st. Town Council. Fifty tramcar bodies and trucks, with electrical equipment and magnetic track and wheel brake equipments, &c.; also one electrically-operated car traverser. (October 3rd.)

Liverpool.—October 21st. Electricity Supply Department. Motor-generator sets. (October 3rd.)

London. — Central Electricity Board. — October 20th. Metering equipment for certain stations in connection with the Mid-East England Electricity Scheme. (September 5th.)

November 3rd. 132,000-V overhead transmission lines for the South-West England and South Wales Electricity Scheme. (September 26th.)

November 3rd. 132,000-V overhead transmission lines for the North-East England Electricity Scheme. (September 26th.)

November 3rd. Construction of site works, foundation works and buildings in the area of the Central England Electricity Scheme. (September 26th.)

November 10th. 66,000-V transformers. (See this issue.)

County of London Electric Supply Co., Ltd.—October 24th. Two 75,000-kW c.m.r. turbo-alternators, circulating water screening plant, condensing plant and auxiliary apparatus, and overhead electric travelling cranes, in connection with Barking power station extensions. (September 19th.)

November 11th. Circulating water pumps and pump house equipment, in connection with Barking power station extensions. (See this issue.)

London County Council.—October 13th. Wiring and fittings for electric lighting (1,375 points) in tenement dwellings at Glebe housing estate, Peckham. (September 26th.)

November 3rd. Two 20,000-kW turbo-alternators, condensing plant, &c. (September 26th.)

India Store Department.—October 15th. 20,000 negative elements for Leclanché cells. (September 26th.)

H.M. Office of Works.—October 20th. Electric wire and cable. (See this issue.)

New Zealand.—Wellington.—Post and Telegraph Department. November 4th. Telephone cable. (A.X. 10242.)*

November 20th. Telephone cordage. (A.X. 10243.)*

November 25th. Rubber insulator rings. (A.X. 10,293.)*

Automatic table telephones. (A.X. 10,295.)*

December 2nd. Automatic dials. (A.X. 10294.)*

Omagh, Co. Tyrone.—October 21st. Urban District Council. A.c. house service type meters. (See this issue.)

Smethwick.—October 31st. Education Committee. Electric lighting of the Uplands School. (September 26th.)

South Africa.—Pretoria.—November 21st. Department of Posts and Telegraphs. Dry cells and battery material. (A.X. 10244.)*

Durban.—October 24th. Corporation Electricity Department. Ten single-phase transformers. (A.X. 10277.)*

Cape Town.—City Electricity Department. November 27th. Thirteen 3-phase transformers. (A.X. 10322.)*

Stanley.—October 15th. Urban District Council. Electricians' work required in erection of 42 houses. Particulars from S. Grove, Clerk to Council, Pearl Chambers, East Parade, Leeds.

Stone.—October 15th. Electricity Department. Outdoor sub-station equipment and l.p. overhead and underground distribution networks. (October 3rd.)

Turkey.—Ankara.—October 16th. Direction-General of Posts, Telegraphs and Telephones. Porcelain insulators and copper sleeves. (A.X. 10260.)*

Uruguay.—Montevideo.—October 31st. Public Cleansing Department. 1,000-kW turbo-generator, switchgear, transformers and waste fuel boilers. (A.X. 10180.)*

October 31st. State Electricity Supply Works. Electricity meters and spares. (A.X. 10254.)*

Warmley.—November 8th. Rural District Council. H.p. and l.p. cables with poles, switchgear and transformers. (See this issue.)

West Hartlepool.—Second-hand d.c. prepayment meters; also one 150-h.p. d.c. motor. (See this issue.)

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.

Contracts Closed.

Beddington and Wallington.—Urban District Council. Accepted :—
Electrically-driven sewage pumping plant (£197).—Pulsometer Engineering Co., Ltd.

Bradford.—Education Committee. Accepted :—
Electric lighting of schools.—Haley & Atherton.

Burton-on-Trent.—Electricity Committee. Accepted :—
Three 1,000-kVA transformers (£1,374).—Metropolitan-Vickers Electrical Co., Ltd.

Chelmsford.—Essex C.C. Recommended :—
Electric clocks at county offices (£97).—Gent & Co., Ltd.

Colchester.—Education Committee. Accepted :—
Installation of electric light at Canterbury Road schools (£110).—E. Baillie & Co.

East Ham.—Electricity Committee. Accepted :—
250-kVA transformer (£137).—English Electric Co., Ltd.
Switchboard (£294), cable boxes and raising and lowering gear.—New Switchgear Construction Co., Ltd.
Switchboard extension at Church Road sub-station (£194).—Switchgear & Cowans, Ltd.
Cable (£1,027).—Enfield Cable Works, Ltd.

East Suffolk.—County Council. Accepted :—
Five sets of automatic traffic signals (£628).—Siemens and General Electric Railway Signal Co., Ltd.

Glasgow. — Corporation Lighting Committee. Recommended :—
500 lanterns (large), 500 lanterns (small).—Wardle Engineering Co.
1,000 steel poles.—Stewarts & Lloyds, Ltd.
Cable.—Mersey Cable Works, Ltd.
Electricity Committee. Accepted :—
Rotary convertors (reconstructed).—Bruce Peebles & Co., Ltd. (£2,759); Crompton Parkinson, Ltd. (£1,800); Metropolitan-Vickers Electrical Co., Ltd. (£5,967).

Guildford.—Housing Committee. Accepted :—
Wiring 44 houses on Stoughton estate (£294).—A. Grove.
Tenders were received ranging up to £500, whilst one was over £1,000.

Leeds.—Electricity Committee. Accepted :—
Cables.—W. T. Henley's Telegraph Works Co., Ltd. (£358); Macintosh Cable Co., Ltd. (£304); Hackbridge Cable Co., Ltd. (£1,066); Derby Cables, Ltd. (£3,850); Edison Swan Cables, Ltd. (£1,102); Croydon Cable Works, Ltd. (£1,550).
Improvements Committee. Accepted :—
Two passenger lifts at Headrow offices (£1,612).—Express Lift Co., Ltd.
Tramways Committee. Accepted :—
Three miles of trolley wire.—British Insulated Cables, Ltd.

Liverpool.—Tramways and Electric Power and Lighting Committee. Accepted :—
5,000 35-in. and 200 65-in. copper bonds.—British Insulated Cables, Ltd.

London.—G.P.O. Accepted :—
"Kye" vacuum lamps.—British Electric Transformer Co., Ltd.
Stoke Newington.—
Electrical installation in 17 houses at Stamford Hill.—Rovner Bros.

Manchester.—Housing Committee. Accepted :—
Electric lighting installation at houses on the Withington estate.—R. H. Clampnett & Co.
Baths Committee. Accepted :—
Heaters and fans and wiring for motors at Armitage Street and Miles Platting baths.—Ogden Engineering Co.
Paving Committee. Accepted :—
Automatic traffic signals.—Forest City Electric Co., Ltd.

Northampton. Watch Committee. Recommended :—
Automatic traffic signals (£1,236).—Forest City Electric Co., Ltd.

Oldham.—Electricity Committee. Accepted :—
L.p. cable.—Derby Cables, Ltd.; Union Cable Co., Ltd.
Education Committee. Accepted :—
Installation of electric lighting at Limeside school.—Hulton & Hinchcliffe.

Severalls.—Essex and Colchester Hospital Joint Committee. Recommended :—
X-ray apparatus for mental hospital (£592).—A. E. Dean and Co.

Forthcoming Events.

Institute of Transport.—October 13th. Institution of Electrical Engineers, Savoy Place, Victoria Embankment, W.C. 5.30 p.m. Presidential address. Sir Arthur Stanley.

Institute of Marine Engineers.—October 14th. 85, The Minories, E.C. 6 p.m. "The Design and Manufacture of Marine Auxiliary Oil Engines." Mr. O. Wans.

Overhead Lines Association.—October 15th. Institution of Electrical Engineers, Savoy Place, Victoria Embankment, W.C.2. 5.30 p.m. Annual general meeting.

Electroplaters' and Depositors' Technical Society.—October 15th. Northampton Polytechnic Institute, St. John Street, Clerkenwell, E.C. 8.15 p.m. "Practical Difficulties in the Electro-deposition of Chromium." Mr. J. W. Cuthbertson.

British Institute of Radiology.—October 16th. The Institute, 32, Welbeck Street, W.1. 8.30 p.m. Short papers.

Society of Radiographers.—October 16th. Institute of Radiology, 32, Welbeck Street, W.1. 7 p.m. Presidential address. Mr. C. L. Winch.

Motor Show.—London, Olympia. October 16th-25th.

Faraday House Old Students' Association.—October 17th. Savoy Hotel, Strand, W.C. 6.30 for 7 p.m. Annual dinner.

Junior Institution of Engineers.—October 17th. 39, Victoria Street, S.W. 7.30 p.m. "The London Automatic Telephone System." Mr. T. H. Flowers.

Institution of Mechanical Engineers.—October 17th. Institution, Storey's Gate, St. James's Park, S.W. 6 p.m. Presidential address. Mr. L. St. L. Pendred.

Association of Supervising Electrical Engineers.—October 21st. Junior Institution of Engineers, 39, Victoria Street, S.W. 7.15 p.m. Presidential address. Mr. S. B. Donkin.

Institute of Fuel.—October 22nd and 23rd. Incorporated Accountants' Hall, London. Annual conference. October 22nd. Connaught Rooms, Great Queen Street, W.C. 6.45 p.m. Annual dinner and dance.

Institution of Electrical Engineers.—October 23rd. Institution, Savoy Place, Victoria Embankment, W.C. 6 p.m. Inaugural address. Mr. C. C. Paterson.

Notes.

An Insulated River.

The following is an extract from a letter received by Mr. J. H. C. Brooking, from Mr. E. Hitchcock, of the Municipal Electricity Department, Christchurch, N.Z.

"The verses 'Cleanliness *versus* Insulation' in the *Electrical Engineers' Ballad Book* remind me of an interesting comparable experience which happened in this city some years ago. The city is situated on the Canterbury Plains, most of which are extensive shingle beds. Our reticulation is an earthed-neutral system. In some localities it is exceedingly difficult to secure a good earth. In the outskirts of the city, some of the houses took their water supply from a race. The neutral of the electrical installation was earthed to the water pipe. A fault developed, and the pipe was made alive right back to the race. The ground was of such high resistance that the race itself became alive, and the water virtually an insulated conductor. Someone noticed horses approaching the race lower down, to drink. Immediately their lips touched the water, they threw up their heads and galloped. Someone investigated matters and received a shock. The supply engineer was advised that the race was 'alive.' He scorned the idea but went out to investigate. He stood on the edge and threw in the end of a piece of fence wire, and was knocked down. Investigation traced the trouble back to the fault in the house. The water was running on clean pebbly shingle. The man and the horse were standing on a covering of turf. The difference provided conditions for the shock."

Institute of Fuel.

The two-day Conference of the Institute will be held on October 22nd and 23rd, at the Incorporated Accountants' Hall, Victoria Embankment, W.C., and not at the Institution of Electrical Engineers as previously arranged. The proceedings of the first day will include the presidential address by Sir David Milne-Watson, LL.D.; a paper by Mr. J. Lubbock, M.A., on "The Industrial Uses of Fuel Oil"; a paper by Dr. E. W. Smith on "The Use of Coke Breeze for Industrial Purposes"; and the annual dinner and dance at the Connaught Rooms, Great Queen Street, in the evening. The whole of the second day will be devoted to a symposium on the subject of "Fuel Problems in the Mercantile Marine."

Nickel-plating for Mass Production.

An informative paper of interest to nickel platers who require to work at high current density, but nevertheless wish to produce as efficient a deposit as possible, was recently read before the Electroplaters' and Depositors' Technical Society by Mr. N. R. Laban, who thought that the difficulties involved were reminiscent of those encountered in chromium plating; but in his view the advantage obtained was not merely one of speed, but of better-quality deposits also, as compared with nickel plating at low current density. Current densities between 60 and 100 A. per sq. ft. were quite a practical proposition for the majority of the components used in motor and cycle work. Any plant which was capable of giving good results at, say, 30 A. per sq. ft., could be made to operate at high c.d. with slight modifications. The substitution of electrolytic cleaning for hand-scouring was necessary before the full advantages of medium or high c.d. deposition could be appreciated; except in special cases, it should be unnecessary to employ labour in scouring. The electrolyte consisted of strong sulphuric acid containing about 3 oz. per gallon of potassium bichromate. The lead lining of the vats was the cathode on a 6-volt supply, or, if preferred, lead sheets could be used as cathodes insulated from the vat lining. The placing of the work on the anode bar completed the circuit, and for a few seconds a heavy current passed (up to 100 A. per sq. ft.), rapidly falling as the steel became passive until, after about 30 seconds, a steady current of about 20 A. per sq. ft. passed. The oxygen evolved performed the triple duty of oxidising the grease to non-greasy organic matter, rendering the steel passive, and exerted a scouring action. After ½ to 1 minute in the cleaner, the articles were transferred to the swills. The steel surface had a dull satin surface, the brilliant polish being completely destroyed. A perfect "key" was provided for the deposit, and the fine etch obtained did not interfere with the final nickel mopping. The acid was maintained between 50 and 55 deg. Be, more or less than that was liable to produce severe etching. As an illustration of the effectiveness of the cleaner, the percentage of work that stripped during chromium plating averaged 0.5 per cent., the output being 12,000 components per week. If cases of stripping did occur, they were mainly due to double deposits. In production, an anodic cleaner of about 100 gallons capacity would handle the same quantity of work as might be expected from three scourers, and had the advantage that unskilled labour could be employed.

Ships' Distribution Voltage.

Some of the earlier electrical installations on ships were designed for a voltage of 65. The need for economy and the improvements in electrical wiring and fittings led to the adoption of 110 volts for all purposes. Soon, further great advances in the design and construction of electrical apparatus caused the employment of 220 volts for all power purposes, but even at the present time 110 volts is very commonly employed for lighting circuits on board. Many shipowners and electrical engineers are, however, of opinion that there is no necessity for this excess of caution, and in a large number of vessels the lighting is now effected at 220 volts, but there will be still further advance, and there is really no reason why the economy that could be effected should not be made. The *Motor Ship* understands that the first 440-volt installation will be carried out in the near future, and the wider adoption of the higher pressure will not be greatly delayed.

Refuse Destructors in France.

Although the utilisation of household refuse for the generation of electricity has been widely employed in England for many years, this method of disposal is practically unknown in France. An article in *Le Génie Civil* of August 10th describes, somewhat as a curiosity, a destructor put into service at Issy les Moulineaux in 1927 by La Société de Traitement Industriel des Résidus Urbains. This plant has received daily from 500 to 850 tons of household refuse; it consists mainly of appliances for the delivery of the refuse to six furnaces, apparatus for the extinction and crushing of the clinkers, a brick works in which the clinkers, with the addition of 5 to 7 per cent. of lime, are transformed into bricks, and an electric generating station fitted with Schneider turbo-alternators. This plant produces 28½ million kWh yearly from the consumption of 173,000 tons of refuse, without the addition of any other fuel. The maximum return is 177 kWh per ton of refuse, and the minimum is 136 kWh. The company has two other destructors at Romainville and at Ivry, and the total production of electricity of the three installations is 70 million kWh per annum.

The Exhibition of Inventions.

Many exhibits of electrical interest were displayed at the International Exhibition of Inventions held at the Central Hall, Westminster. The Exhibition is organised by the Institute of Patentees (Inc.) for the purpose of bringing together the inventor, the manufacturer, and the financier, and prizes are presented for what are considered by the judges to be the best of the new inventions displayed. Some fifty manufacturers and distributors took part in the trade section of the Exhibition. Prominent among these are Messrs. Berry's Electric (1928), Ltd., who on a spacious and tastefully-displayed stand exhibited their latest models of "Magicoal" electric fires. A range of electric lamp-locks for preventing the unauthorised removal of electric lamps was shown on the stand of Messrs. J. A. Brook, while the Ideal Home Electrical Appliances, Ltd., displayed a miscellaneous collection of domestic electrical appliances including hair-dryers, fans, immersion heaters, ultra-violet-ray and radiant heat apparatus, parlour-'phones and ozonisers. On the well-equipped stand of the Tellus Super Vacuum Cleaner, Ltd., could be seen the latest types of the company's vacuum cleaning apparatus. A domestic pumping set, called the "Ace," shown by the S.A.M. Pumps Co., has been specially designed to deal efficiently with all the pumping jobs usually found on an estate and in the country house. A form of electrically-operated publicity device called the "Transformator" formed the exhibit of Messrs. M. Enoch & Sons; this is an artistically-designed cabinet displaying various-shaped panels of glass upon which the advertising matter is made to appear. The S.O.S. Switch Co. showed an automatic cut-out switch for coil ignition; this switch is operated by the suction of the engine and has the advantage of requiring no lubrication or adjustment. Various improvements in non-spillable accumulators were demonstrated on the stand of Messrs. Rowland Edwards and Co. In the new inventions section the most numerous electrical exhibits were those appertaining to railway and motor-car signalling apparatus, anti-dazzle head-lamps, switches and improvements to lighting shades and reflectors. Of the other recent inventions, the most interesting included improved cable grip connectors, a domestic iron-heated hot-plate, an automatic starting apparatus for dirt track racing, a fire-alarm cable, a combined ammeter and battery meter, remote-control apparatus, improved connectors for domestic appliances, electric advertising signs and devices, clocks, a heating fan, a thermo-automatic vending machine for the sale of hot foodstuffs, and an automatic coin-freed gramophone.

The Electrical Association for Women.

The members of the Birmingham and Midland Branch of the E.A.W. held their opening meeting of the autumn session at the Grand Hotel, Birmingham, on September 23rd. Several visits and instruction classes have been arranged for the coming session, including an illustrated and experimental lecture on television by Dr. Kranmer, at which the chair will be taken by Dame Ethel Shakespeare, D.B.E., D.Sc.

The autumn and winter London fixtures of the Association include: October 16th, display by Mrs. Llewelyn B. Atkinson of her latest electrical films; October 28th, visit to Woolwich works of Messrs. Siemens Bros. & Co., Ltd.; November 6th, lecture by Miss Beatrice Irwin on "The New Art of Illumination"; November 13th and 17th, visits to Bachelor Girls' Exhibition, New Horticultural Hall, London, at which the Association is organising a bachelor girl's electrical flat; November 25th, talk by Mr. F. G. Quance on "Outlet Accessories": November 26th, talk by Mrs. A. Leevers on "Housekeeping in Japan"; December 4th, lecture-demonstration by Miss Dorothy Vaughan on "Laundry Problems"; December 10th, visit to works of Vac-Tric, Ltd., Cricklewood.

Educational.

The recently-established Technical Engineering College of Correspondence Instruction (Principal: Mr. W. S. Ibbetson, B.Sc.), Crown Chambers, Regent Street, S.W.1, offers a number of courses of instruction for engineering students.

The L.C.C. School of Engineering and Navigation, High Street, Poplar, commenced a special course of 10 lectures on "Electricity in the Home" on October 7th. They are being delivered by the principal, Mr. J. Paley Yorke, with demonstrations designed to instruct, not only users, but also teachers of domestic subjects and women employed in electrical showrooms.

The Generation of Electricity.

As the outcome of the publication of their monthly statements showing the number of kWh of electricity generated by authorised undertakers in Great Britain, the Electricity Commissioners were asked whether corresponding monthly particulars for the past two complete years could be made available for comparative purposes. The desired figures are accordingly set out below:—

kWh generated by Authorised Undertakers (approximate figures).

Month.	1928. Millions.	1929. Millions.	1930. Millions.
January	865	1,033	1,072
February	791	938	982
March	816	873	963
April	670	807	837
May	694	753	818
June	630	694	709
July	635	732	786
August	624	706	721
September	670	755	
October	838	949	
November	895	1,005	
December	945	1,049	
Totals	9,073	10,294	

It will be noted that in each month in 1929 the output (kWh generated) showed an increase over the output in the corresponding month of 1928. Similarly the output in each of the first eight months of 1930 showed an increase over that in the corresponding months in 1929.

Electricity Charges in North Berwick.

The difficulty experienced in relating prices charged to consumers with costs of production is illustrated by recent correspondence in the *Haddingtonshire Courier*. Sir Edward Sharpey-Shafer (formerly chairman of the North Berwick Electric Light & Power Co.) draws attention to the fact that, while the cost of the bulk supply received by the undertaking of North Berwick Burgh (engineer: Mr. E. T. Pound) from Portobello power station is a little over ¼d. per kWh, the charge to the lighting consumer is 10d. per kWh. In the course of a rejoinder, Mr. G. Eeles (provost) states that the price paid to the suppliers is 0.525 pence per kWh, *plus* a kVA charge, which for the past year amounted to £690, bringing the cost to 1¼d. per kWh at the transforming station and 1.45 pence per kWh sold. Other costs must be added as follows:—(1) Cost of bulk supply per kWh sold, 1.45d. (2) Repairs and maintenance, 0.61d. (3) Rent, rates, taxes, and insurance, 0.41d. (4) Administration and management, 0.5d. (5) Interest and instalments of capital repaid, 2.78d. Total, 5.75d. The average price received is barely 6d. per kW. No. 5 includes interest on and instalments of loan raised to pay for the original undertaking (£10,750). The whole of the plant, except a length of cable, has since been scrapped, so that the greater part of the price may be looked upon as goodwill, and is unproductive.

The two-part system of charging which it is proposed to introduce will not be expected to benefit those who use only a minimum of current in relation to their installations, but it is offered to encourage consumers to make a more extensive use of electricity for purposes other than lighting. The Town Council has cancelled the charge for meter rent, and, as soon as the audit of the accounts is completed, the possibility of a reduction on the flat rate for lighting will be considered.

The Treatment of Flue Gases.

A provisional patent specification of great importance (No. 334,660) has been published, describing the method of and apparatus for the treatment of flue gases, residual trade gases, and the like. The invention is in the joint names of the London Power Company, Ltd., and Dr. S. L. Pearce. Its object is to devise means for the treatment of flue gases, fumes, or vapours ordinarily discharged into the atmosphere, whereby any obnoxious products may be abstracted from such gases before final discharge, so as to render them substantially innocuous or such as not to constitute a source of annoyance in the vicinity, and also to enable any marketable constituents to be readily recovered. The gases before discharge are first led through a chamber containing means for thoroughly saturating them, after which they are washed and scrubbed, the direction of flow being preferably changed between successive operations, so as to facilitate the separation from the gases of any impurities abstracted. The gases before discharge and after preliminary treatment are ozonised.

At the outlet end of the saturation chamber the gas is submitted to a thorough douching by means of sprays, and at the same time the direction of flow of the gases is altered and they are passed through a series of scrubbers of wood, fireclay, metal tubes, or other suitable packings in absorption towers. The direction of flow is preferably again changed so as to facilitate the throwing-down of a portion of the entrained liquid, and the gases are then passed through an additional bank of scrubbers, wetted with an alkaline wash-water or other fluid for final treatment. After treatment with alkaline wash-water the gases are conducted through eliminator plates constructed so as to prevent the emission of free moisture to the atmosphere, the gases finally passing to the chimney proper, where provision is made for the admixture of air with the gases, so as to reduce the saturated condition of the gases and to dilute them as finally discharged to atmosphere.

The atomising liquid in the initial stage should be at a temperature of about 175 to 180 deg. F., while the liquid employed for douching the gases is at atmospheric temperature, but arrangements are preferably made in every stage of the process to vary the temperature of the wash-water as may be found best suited to the character or constitution of the gases to be treated. By means of this invention, it is claimed, flue gases may be treated for the removal and elimination of grits, smoke, compounds of sulphur and other objectionable constituents; the nature of any reagents employed in the different stages of treatment will be in general determined by the character of the gases to be treated.

Noise Associated with Lightning.

In the correspondence columns of *Nature*, particulars are given of a curious effect on a lighting installation at Bell Hill during the thunderstorm which burst upon Petersfield on the night of August 29th-30th.

The lightning was first noticed shortly after 9 p.m., and flashed incessantly every ten to thirty seconds, but it was not at its nearest to Bell Hill until 1 a.m. to 2 a.m., when, to judge from the interval of one-fifth to half a second between the flash and the thunder, a storm centre was within 500 feet.

At the time of observation there were no lights burning in the house. Simultaneously with the nearest lightning flashes, an electric light bulb, hanging from the ceiling, emitted a bluish green light, which flickered and quivered in correspondence with the lightning. This was accompanied by a click in a small pear switch of the lamp in question. Thunder followed the click, after an interval. Other bulbs in the same circuit appear to have been unaffected, which may perhaps be due to the better insulation of their switches. It was next found that the current had failed, and it was afterwards learnt that the supply throughout the whole of Petersfield was interrupted at approximately 12.50 a.m., owing to a surge on the high-pressure line.

It is suggested that a current, induced in the mains, jumped the switch and illuminated the lamp.

Co-ordination of London Passenger Transport.

The Minister of Transport (Mr. Herbert Morrison) announces that the Government proposes to introduce legislation with a view to co-ordinating the undertakings engaged in passenger transport in the London area. He recalls the announcement made in Parliament on December 2nd, 1929, as follows:—(*i*) Uneconomic and unnecessary competition must be eliminated. (*ii*) The objects in view could best be achieved by securing unification, under public control, of passenger transport by omnibus, tramway, and local railway in the London traffic area. A single and simple form of public ownership should, therefore, be substituted for the complicated network of separate private and municipal interests now existing. (*iii*) The principle of public ownership should be combined with the principle of commercial management, thus ensuring the advantages of vigorous business enterprise.

The Government accordingly proposed to create a new statutory public body, which would embrace the railway, omnibus, and tramway undertakings controlled by the Underground Electric Railway Co. of London, Ltd.; the Metropolitan Railway; the tramway undertakings owned by local authorities within the London area; and other omnibus undertakings operating within the London area. This new body is to be charged with the future management, operation, and maintenance of one consolidated undertaking, and with the duty of making provision for further facilities as and when required.

As the suburban lines of the amalgamated railway companies are inextricably bound up with the main lines there would be great difficulties in bringing those lines into any scheme of unified ownership, and the Government does not contemplate that the existing ownerships should in this case be disturbed.

The Government aims at combining business-like management with public ownership by the creation of a small board consisting of persons of proved business capacity. Every effort will be made to secure the services of a chairman who will combine business acumen and vigour with wide knowledge and experience, and who can be trusted to ensure that the appointment of officers of the Board will be governed by considerations of efficiency. Such a Board should function as freely as possible from political interference so far as questions of management were concerned.

Provision would be made in the Bill for securing fair and proper treatment for officers and employés of the undertakings to be taken over.

It is undesirable in advance of the discussions to lay down definitely the sphere of operation of the Traffic Board, but all passenger services by road which serve London and its immediate surroundings must be concentrated in the hands of the Board. Long-distance road services between London and provincial centres will be considered in relation to the functions and powers of the new Board only in so far as they may compete with the services to be provided by the Board by picking up and setting down passengers within a prescribed distance of London.

The new authority will have no interest in extending particular forms of transport, and no tramway, tube, or omnibus bias, but its transport policy is to be determined by technical fact and the public interest.

B.S.S. for Leclanché-type Cells.

The British Engineering Standards Association has just issued a new specification, No. 397-1930, for Leclanché-type primary cells. This specification deals with cells of which the active elements are zinc, carbon, manganese-dioxide and ammonium chloride, and covers dry, inert and wet types of cells. Standard dimensions are given for the various types of cell, together with the appropriate connecting wires and terminals; standard requirements for zinc, and for the electrolyte for wet cells are also laid down. Tests are given to ensure compliance with the specification, comprising tests for initial internal resistance, polarisation and output. An appendix dealing with an optional storage test is also included. Copies of this specification, No. 397-1930, may be obtained from the Publication Department, British Engineering Standards Association, 28, Victoria Street, S.W.1, price 2s. 2d. post free.

Appointments Vacant.

Switch-room engineer for Croydon Electricity Department.

Electrician-wireman for Croydon Mental Hospital.

Chief engineer and manager for Great Yarmouth Electricity Department.

Plumber-jointers for Brighton Electricity Department.

Linesman for N.W. Midlands Joint Electricity Authority.

(See our advertisement pages to-day.)

A Grid Line Inquiry.

An inquiry was held at the offices of the Woodford Urban District Council on September 30th into the route proposed by the Central Electricity Board for the erection of overhead lines to connect the Barking and Brimsdown power stations. Lt.-Col. Gordon Tucker presided on behalf of the Ministry of Transport. Speaking for the Central Electricity Board, Mr. O. A. Sherrard, the deputy secretary, stated that the proposed route had been one of the most difficult to choose, since it passed over so much land which was either already built on, or about to be developed, or used as sports grounds. Wayleaves had already been obtained for the whole of the route, except the Ilford and Chingford sections. For the Chingford Council, Mr. G. H. Green, the town clerk, suggested that the route should follow the aqueduct of the Metropolitan Water Board on account of the depreciation of property which would be caused by the erection of towers.

An official inspection of portions of the routes objected to was made on October 1st.

Association of Mining Electrical Engineers.

The South Wales Branch of the Association of Mining Electrical Engineers held its first general meeting at Cardiff on October 4th. The retiring branch chairman, Mr. W. W. Hannah, presided and welcomed Mr. W. D. Wight, vice-chairman of the Monmouthshire and South Wales Coal Owners' Association, who presented prizes for papers read before branches by members or their subordinates who sign the log book under the Coal Mines Act. Certificates were also presented to the successful candidates at the last examinations. Referring to the increasing importance of the Association's certificates, Mr. Wight said a certain committee of the Coal Owners' Association recently recommended, in the event of the Government making qualifications compulsory for posts under the Mines Act, that their Association's certificates should be accepted. The incoming branch chairman, Sir Arthur Whitten Brown, K.B.E., subsequently presided, and expressed the hope that the recommendation of the Coal Owners' Association would result in their certificates being regarded as the criteria for responsible officials on the electrical side of mining work.

Institution Notes.

Institution of Electrical Engineers.

The 1930-31 session opens on October 23rd with the inaugural address of the president, Mr. C. C. Paterson. On November 6th Mr. D. B. Hoseason will deal with "The Cooling of Electrical Machines," and on November 20th Mr. G. Bianchi will present "Some Data Concerning Railway Electrification in Italy." On December 4th Mr. S. G. Brown is to lecture on "Loud-speakers since their Conception, with Gramophone Pick-ups and Wireless Recording Apparatus" (with demonstrations), and on January 8th, 1931, Mr. C. E. R. Bruce will explain "The Distribution of Energy Liberated in an Oil-immersed Electric Arc," with a contribution to the study of arc temperature (Electrical Research Association's report).

Informal Meetings.—The following is a list of arrangements made for meetings commencing at 7 p.m.:—

October 27th.—Discussion on "The Link between Sales, Manufacture and Research." (Opened by Mr. C. C. Paterson, O.B.E., President.)

November 10th.—Discussion on "V.I.R. Cables, their Failures, their Future and their Rivals." (Opened by Mr. A. F. Stevenson.)

November 24th.—Discussion on "The Syllabuses of Day and Evening Courses in Electrical Engineering—Do they meet Commercial Requirements?" (Opened by Mr. J. Paley Yorke, M.Sc.)

December 8th.—Discussion on "Impluse *versus* Synchronous Time Service." (Opened by Mr. A. O. Gibbon and Lt.-Colonel K. Edgcumbe, R.E. (T.A.).)

January 12th, 1931.—Discussion on "The Packing and Transport of Electrical and Allied Machinery." (Opened by Mr. J. F. Shipley.)

January 26th.—Discussion on "Reliable Fractional Horse-power Motors for Commercial Purposes." (Opened by Mr. L. Murphy.)

February 9th, March 2nd, 16th, 30th, April 20th.—Subjects to be arranged.

North-Eastern Students' Section.—The first meeting of the 1930-31 session is being held to-night at Newcastle, at which Mr. G. Walters, chairman, is delivering his inaugural address.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

Mr. A. J. Pratt, of the G.P.O. Telephone Service, is this session's chairman of the Mersey and North Wales (Liverpool) Centre of the Institution of Electrical Engineers. Mr. Pratt

Elliott & Fry [*London.*

Mr. A. J. Pratt.

Chairman of the Mersey and North Wales (Liverpool) Centre of the I.E.E.

was educated at High Pavement School and University College, Nottingham, and entered the P.O. Engineering Department in that city as an engineering clerk in 1900. In 1905 he was promoted to the Engineer-in-Chief's office, London, at the time when the Post Office telephoning of London was in progress. He spent successive periods of training on cable testing at the North Woolwich cable factories, the Post Office instrument factory at Holloway, and the trunk exchange, Carter's Lane. He subsequently became assistant engineer-in-charge of the telephone engineering development work of Liverpool and District, and is now sectional engineer of the P.O. telephones at Liverpool.

Mr. George Ellison, Junior, is at present on a tour of South Africa in connection with the business of his company which is handled in the Union by George Ellison (S.A.), Ltd., Johannesburg.

Mr. Eric Wilcock, of the staff of the Dewsbury Corporation Electricity Department, who was married on September 25th to Miss Dorothy Tolson, was presented by his colleagues with a timepiece.

Mr. Harry Nance, who has been representing Messrs. Drake and Gorham Wholesale, Ltd., for over 20 years, seven of which have been spent in the Cardiff area, recently left the service of the company.

Mr. C. M. Baroni, who has been associated for many years with Messrs. Ercole Marelli & Co., S.A., machinery manufacturers of Milan, and Messrs. Marelli & Co., Ltd., of London, has been appointed director of the latter company.

Councillor Leonard F. Christy, who has accepted the mayoralty of Chelmsford, is a governing director of Christy Bros. & Co., Ltd., electrical engineers and contractors. He has been a member of the Town Council since 1913.

Mr. C. W. Jackson, who was selected from a number of candidates for the position of general manager and engineer of the Great Yarmouth electricity undertaking, has withdrawn his application, and the post is consequently being re-advertised.

Mr. G. M. Harvey has been appointed deputy electrical inspector of coal mines and inspector of metalliferous mines and quarries.

Mr. G. Rogers is the new chairman of the South Midland Centre of the Institution of Electrical Engineers. Mr. Rogers received his technical education at the Birmingham Technical College, and in 1900 joined the staff of the Birmingham Electrical Supply Co., Ltd., under Mr. J. C. Vaudrey. The plant installed at that time was about 2,000 kW. Later the Corporation bought out the company, and Mr. R. A. Chattock succeeded Mr. J. C. Vaudrey as city electrical engineer. Mr. Rogers served as a junior in various departments, and after five years' experience in the Mains Department, was transferred as assistant engineer to the sub-station engineer, a position to which he succeeded in 1918. He was responsible for large developments in the city sub-stations, and for the design and introduction of automatic rotary convertor and mercury-arc rectifier sub-stations, which have proved very successful in operation. He was granted the John Hopkinson premium in 1924-5 by the I.E.E. for a paper on "Automatic Rectifier Sub-stations." In 1928 he was appointed sub-station engineer and switchgear engineer, and was responsible for the whole of the electrical equipment in the new Hams Hall generating station. He became engineer-in-charge of the frequency-change of the Birmingham undertaking in 1929. In this capacity he is responsible under the city electrical engineer and the secretary and commercial manager for the whole of the change-over of the generating plant, sub-station plant, and consumers' plant from 25 cycles to 50 cycles.

Mr. G. Rogers.
Chairman of the South Midland Centre of the I.E.E.

Mr. Oswald G. Cook's appointment as electrical engineer has been confirmed by the Barnoldswick Urban District Council.

Mr. L. Gill, who is retiring from the staff of the Huddersfield Corporation Tramways after long service, has been presented by his colleagues with an eight-day clock and a smoker's outfit.

Mr. and Mrs. Edgar Moodycliffe, of Dumfries, celebrated their silver wedding on September 23rd. Mr. Moodycliffe is partner in the firm of Gordon & Moodycliffe, electrical engineers, of Dumfries, and prior to going to that town in 1919 he was on the staff of Messrs. T. W. Broadbent & Co., Ltd., Huddersfield.

At a recent meeting of the Bradford Tramways Committee the town clerk submitted a letter from **Mr. R. H. Wilkinson,** requesting the Corporation to release him from his engagement as tramway manager in December next on account of the state of his health. The Committee recommended that he should be granted a superannuation allowance, and decided to advertise for a successor at a minimum salary of £1,250 per annum rising to a maximum of £1,750 per annum.

Mr. T. Stirk, traffic superintendent of the Bradford City tramways, has been appointed acting tramway manager (following the retirement, on medical grounds, of Mr. R. H. Wilkinson, general manager) until such time as a new general manager is appointed and takes office. The Tramways Committee is in consultation with Mr. C. J. Spencer (London United and Metropolitan Tramways), who was Bradford's first tramway manager and Mr. Wilkinson's immediate predecessor, with a view to the reorganisation of the Bradford undertaking.

Mr. Edwin Seddon, the chairman of the Scottish Centre of the I.E.E., was in the service of the West Ham Electricity Department between 1904 and 1912, not from 1912 to 1920, as stated in this column last week. He became chief assistant engineer at Edinburgh in 1912. In addition to being chairman of the Scottish Centre this session, he is carrying out his second year of office as president of the Royal Scottish Society of Arts. Mr. Seddon is to deliver his address to the Centre on October 28th.

The Darwen Corporation Salaries Committee recommends that the salary of the borough electrical engineer **(Mr. F. M. Fletcher)** shall be increased from £600 to £650 as from July 1st last, with an additional increase of £50 to a maximum of £700 as from July 1st, 1931.

Obituary.

Squadron-Leader F. M. Rope.—Amongst the list of those whose loss the nation mourns in the R101 disaster of Sunday morning last appears the name of Squadron-leader F. M. Rope, R.A.F., assistant to the Assistant Director (Technical), who was born in 1888. He took an engineering degree at Birmingham University, and until the year 1912 was with the British Electric Plant Co., of Alloa, after which he joined the Rio Tinto Co. In 1915 he joined the R.N.A.S. and he was some years later appointed Director of the Research Department at airship stations.

Mr. P. F. Crinks.—We regret to record the sudden death, which occurred at Oxford Circus tube station on October 1st, of Mr. Percival Francis Crinks, A.M.I.E.E. (since 1901), general manager of Metro-Vick Supplies, Charing Cross Road, London. Mr. Crinks, who was 51 years of age, was very widely known and highly respected in the electrical trade, and we feel that his many friends will join with us in expressing deep sympathy with his widow and two children.

Mr. Crinks was a pupil of Mr. H. Faraday Proctor, and later he held several appointments on the engineering staff of the Bristol Corporation Electricity Department. He joined the British Westinghouse Electric and Manufacturing Company in 1910, and for several years represented it in the Western Circuit. After being transferred to the London office of that company, he was appointed London sales manager for Metropolitan-Vickers Electrical Co., and later managing director of Metro-Vick Supplies, Ltd. He was a prominent member of E.L.M.A. and E.D.A. Councils and enjoyed the esteem and respect of all his colleagues and associates. The funeral service took place at St John's Church, Sidcup, where he lived. A large number of his friends were present either at the church or at the Sidcup and Foots Cray Cemetery, including many senior officials of the company among whom were Sir Philip Nash and Mr. McKinstry. The E.D.A. was represented by Lt.-Col. W. A. Vignoles, the director, and Mr. R. L. Acland. Amongst others were Messrs. E. J. Summerhill, E. W. Cooke, Austin Rinder, P. T. Turner, R. G. Parrott, J. Horne, A. Winterbottom, T. C. Hunt, W. H. J. Porter, A. Lacey, R. Smith, N. V. Everton, L. S. Richardson, J. W. Porter, and Arthur W. Cox (representing the ELECTRICAL REVIEW).

Mr. F. G. Hayward.—The death occurred on September 30th, at the age of 38 years, of Mr. Frank Gordon Hayward, of C. Hayward & Sons, electrical engineers, Ashford, Kent. He had been a member of the Urban Council for six years and was closely identified with the development of the Council's electricity undertaking.

Mr. J. F. Collard.—We learn with regret of the death of Mr. J. F. Collard, A.C.G.I., A.M.I.E.E., who passed away on September 26th. Mr. Collard had been the chief electrical engineer, Southern Command, W.D. Salisbury Plain generating station, Tidworth, Hants, since 1913.

Wills.—The late **Mr. E. W. W. Woodeson,** a director of Clarke, Chapman & Co., Ltd., left estate valued at £3,267 (£1,796 net personalty).

Mr. Alfred Hitchcock, a director of the York Town (Camberley) and District Gas and Electricity Co., left estate valued at £132,672 gross (£113,650 net personalty).

The Engineering Golfing Society.

The autumn meeting was held at the Burhill Golf Club on Tuesday, October 1st. In the morning there was an eighteen-hole medal round, and the "Hele-Shaw" Scratch Challenge Cup and memento were won by Squadron-Leader C. H. Hayward with a score of 78. The handicap results were as follows: First Division (handicaps of 10 and under)—"F. J. Walker" Challenge Cup and memento. A. McKinstry 79—4=75. Second prize, H. J. Taylor 83—7=76.

The "P. B. Brown" Challenge Cup and memento, K. W. Macnee 95—17=78. Second prize, E. C. Stevens 96—14=82.

Prizes for the best first and second nine holes were taken by A. P. Patey and P. V. Hunter, respectively.

In the afternoon there was an eighteen-hole round, foursomes against bogey, when the "Hadfield" Challenge Cups and mementos were won by Gilbert Allom and K. W. Macnee with 1 up; the second prizes going to C. Stewart and H. P. Allison with all square.

There were forty competitors.

Financial Section.

New Companies, Returns of Share Capital, Debenture Charges, Reports of Electrical Companies, Dividend Changes, Transactions in Stocks and Shares.

New Companies Registered.

British Portable Sound Equipment, Ltd.—Private company. Registered October 2nd. Capital, £5,000 in £1 shares. Objects: To carry on the business of manufacturers of kinematograph and sound-reproducing apparatus and equipment, radio gramophones, radio receivers, valves, electrical, magnetic, and radio-active instruments and switchboards, &c. The subscribers are: R. F. Darrell, clerk, and C. H. Sleigh, solicitor, 3, London Wall Buildings, E.C.2. Registered office: 87, Regent Street, W.1.

Ostins, Ltd.—Private company. Registered October 2nd. Capital, £1,000 in £1 shares. Objects: To carry on the business of manufacturers of carpet sweepers and labour-saving devices, articles of domestic ware or ornament, metal houshold goods, wireless, telephone and other electrical apparatus, fittings and accessories, electrical engineers, &c. The directors are: G. F. Ostins, manufacturer, and Mrs. M. Ostins, Warwick Road, Solihull, Warwickshire. G. F. Ostins is permanent director and chairman. Registered office: 16/17, Belmont Row, Birmingham.

Furness Electrical, Ltd.—Private company. Registered September 27th. Capital, £500 in £1 shares. Objects: To carry on the business of electricians, electrical, mechanical and general engineers, manufacturers of and dealers in electrical, radio, telephone and television apparatus, &c. The directors are: J. E. Coward, 24, Union Street, Dalton-in-Furness; T. Cornall, 11, Cobden Street, Dalton-in-Furness, electrical engineer. Secretary: J. E. Coward. Registered office: 126, Market Street, Dalton-in-Furness.

Primrose & Primrose (1930), Ltd.—Private company. Registered September 29th in Edinburgh. Capital, £500 in £1 shares. Objects: To carry on the business of general, electrical, constructional, and mechanical engineers, contractors, &c. The directors are: J. K. Downes, 13, Queensborough Gardens, Glasgow, W.2; J. McMaster, Berryknowe, Everard Drive, Bishopbriggs, Glasgow; A. Macaulay, 20, Crathie Drive, Partick, Glasgow, all electrical engineers. Secretary: J. Macmaster. Registered office: 635, Great Western Road, Glasgow, C.2.

Zeiss Ikon, Ltd.—Private company. Registered October 1st. Capital, £10,000 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in optical, scientific, projection, television, and sound-reproducing apparatus, lamps, manufacturing opticians, &c. The directors are: A. F. Degenhardt, 24, Selwyn Road, New Malden (director of Carl Zeiss (London), Ltd.); R. E. Peeling, 66, Valance Road, Alexandra Park, N.22 (director of Garner & Peeling, Ltd.); A. Simoder, 72/80, Schandauer Strasse, Dresden, A.21, Germany (director of Zeiss Ikon A.G., Dresden). Registered office: Polebrook House, Upper James Street, Golden Square, W.1.

Official Returns of Electrical Companies.

Armaflex Parent, Ltd.—Issue on September 9th, 1930, of £500 and on September 16th, 1930, of £200 debentures, parts of a series already registered.

W. J. Furse & Co., Ltd.—Satisfaction in full on June 30th, 1921, of debentures authorised April 26th, 1912, and registered May 8th, 1912, securing £5,000. (Notice filed September 29th, 1930.)

Para Electric Railways and Lighting Co., Ltd.—Capital, £780,000 in 390,000 preference and 390,000 ordinary shares of £1 each. Return dated April 21st. 1930. 325,000 preference and 390,000 ordinary shares taken up. £25,040 paid on 25,000 preference and 40 ordinary shares. £689,960 considered as paid on 300,000 preference and 389,960 ordinary shares. Mortgages and charges, £496,982.

L. J. Healing & Co., Ltd.—Capital, £100,000 in 5,000 preference and 5,000 deferred shares of £10 each. Return dated June 11th, 1930. 2,101 preference and 5,000 deferred shares taken up. £16,010 paid. £55,000 considered as paid. Mortgages and charges, nil.

Oriental Telephone and Electric Co., Ltd.—Capital, £900,000 in 300,000 preference and 600,000 ordinary shares of £1 each. Return dated May 27th, 1930. 188,791 preference and 570,199 ordinary shares issued and fully paid up. Mortgages and charges: £126,938.

Hart Accumulator Co., Ltd.—Capital, £200,000 in 20,000 preference and 180,000 ordinary shares of £1 each. Return dated April 9th, 1930. 19,523 preference and 156,708 ordinary shares taken up. £38,411 paid on 7,059 preference and 31,352 ordinary shares. £137,820 considered as paid on the remainder. Mortgages and charges, nil.

Hart Bros. Electrical Manufacturing Co., Ltd.—Issue on September 13th, of £400 and on September 20th, 1930, of £1,400 debentures, parts of a series already registered.

Mexican Hydro-Electric Development Syndicate, Ltd.—Issue on September 18th, 1930, of £1,350 debentures, part of a series already registered.

E. Shipton & Co., Ltd.—Debenture dated September 13th, 1930, to secure £3,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: Branch Nominees, Ltd.

Duram, Ltd.—Satisfaction to the extent of £45,800 on August 28th, 1930, of debentures created by trust deed and authorised June 24th, 1921, and registered July 14th, 1921.

Tees Power Station Co., Ltd.—Satisfaction to the extent of £20,000 on various dates between April 1st, and September 13th, 1930, of debentures secured by trust deed dated May 7th, 1918. and registered May 24th, 1918, securing £600,000.

A. F. Yarnold, Ltd.—Capital, £2,000 in 500 preference and 1,500 ordinary shares of £1 each. Return dated December 31st, 1929 (filed March 13th, 1930). 350 preference and 685 ordinary shares taken up. £1,035 paid. Mortgages and charges, nil.

Richardsons, Westgarth & Co., Ltd.—Capital, £700,000 in 350.000 preference and 350,000 ordinary shares of £1 each. Return dated June 6th, 1930. All shares taken up. £700,000 paid. Mortgages and charges, £25,605.

Huntalite, Ltd.—Capital, £2,000 in £1 shares. Return dated December 31st, 1929 (filed June 2nd, 1930). 1,800 shares taken up. £1,500 paid. £300 considered as paid. Mortgages and charges, nil.

City Notes.

Companies to be Struck Off the Register.

The names of the undermentioned companies will be struck off the register at the expiration of three months, unless cause is shown to the contrary:—

British Di-Electric Co., Ltd.
Electrix, Ltd.
Harry Morser & Co. (Wireless), Ltd.
Miller's Radio Products, Ltd.
New Union Electric Co., Ltd.
Rio de Janeiro Suburban Tramways, Ltd.
Woolldridge Radio Co., Ltd.

Midland Counties Electric Supply Co., Ltd.

The shareholders have received an invitation to subscribe for 450,000 £1 ordinary shares at the price of 24s. each, in the proportion of one new share for each five shares held. By this offer the issued capital is raised to £4,450,000 (£2,700,000 ordinary).

A. Reyrolle & Co., Ltd.

In connection with the recently-approved capital increase, it is announced that the directors are offering to shareholders 62,500 new preference shares at par and 125,000 new ordinary shares at 25s. each. The basis of allotment is one new preference share for each eight preference or ordinary shares held, and one new ordinary share for each four preference or ordinary shares held.

Musselburgh & District Electric Light & Traction Co.

The report for 1929 states that the electricity undertaking yielded a gross profit of £3,901 and the motor-buses £4,463, but the tramway showed a loss of £3,573. After meeting debenture charges, &c., there is a profit of £1,083, which deducted from the loss of £19,222 brought in, reduced the loss carried forward to £18,138.

The " Underground " Debenture Issue.

On Wednesday last the London Electric Railway Co. and the Central London Railway Co. published a prospectus offering for sale £4,300,000 of 5 per cent. redeemable debenture stock (£3,450,000 offered by the London Electric Railway Co.). The price of issue was £99 10s. per cent. and the stock is redeemable at par on January 1st, 1995, or at the option of the company in whole or part on January 1st, 1985, or on any half-yearly interest date thereafter at six months' notice. The interest ranks as a first charge with that on the existing debenture stocks of the companies. The proceeds of the issue will be employed to finance the large programme of construction and extension which the companies have in hand and towards which a Government grant is being made. The lists were to close on or before October 11th.

Mexican Light and Power Co., Ltd.

Dividends are announced at the rate of 7 per cent. per annum for the half-year ending October 31st on the 7 per cent. cumulative preference shares, and at the rate of 4 per cent. per annum on the 4 per cent. cumulative redeemable second preference shares.

Foreign Light and Power Co.

The report for the year ended June 30th last shows net earnings of $546,947, as compared with $466,780 for the previous year, while the profits from the sale of securities were $88,965.

County of London Electric Supply Co., Ltd.

The directors have notified the holders of the company's 7 per cent. redeemable debenture stock that it intends to redeem the stock on April 3rd, 1931.

Richard Johnson, Clapham & Morris, Ltd.

No dividend is being paid on the ordinary shares for the year ended March 31st, the debit balance being carried forward amounting to £113,275.

Shawinigan Water and Power Co.

An issue of $20,000,000 of 4½ per cent. first mortgage gold bonds is being offered in Montreal and New York at 97½ per cent.

Babcock & Wilcox, Ltd.

The directors have announced an interim dividend of 7 per cent., free of tax (same).

Western Union Telegraph Co.

A quarterly dividend is announced of $2 per share on the common stock, payable October 15th.

North Metropolitan Electric Power Supply Co.

An interim dividend of 4 per cent. (same) has been declared on the ordinary shares.

Callender's Cable & Construction Co., Ltd.

An interim dividend of 5 per cent. (same), less tax, has been declared.

French Companies.

The *Société la Maison Breguet* records net profits of 1,937,000 fr. for 1929-30 as compared with 1,796,000 fr. in the previous year and the dividend is raised from 50 to 60 fr. per share.

The *Compagnie de Signaux et d'Enterprises Electriques* reports net profits and balance forward amounting to 5,057,000 fr. for 1929-30. The dividends proposed are at the rate of 100 fr. on the old " B " shares, 12.50 fr. on the " A " shares, and 50 fr. on the new " B " shares.

Swiss Companies.

The *Motor Columbus Company for Electrical Undertakings*, Baden, proposes to pay a dividend for 1929-30 at the rate of 10 per cent. on the " A " and " B " shares and 6 per cent. on the " C " shares. The *Elektra Company for Applied Electricity*, Zurich, which is a financing company belonging to the Motor Columbus group, records net profits of 2.08 million fr. for 1929-30 against 1.78 millions in the previous year. The distribution on the ordinary shares is at the rate of 5 per cent.

German Companies.

The report of the *Rheydt Cable Works Company* for 1929-30 states that the level of the previous year's turnover was not reached, mainly on account of the reserve displayed in the placing of State and local authority orders, while the unexpected fall in the prices of raw materials induced many consumers to delay awarding contracts. At present the works is not well employed. The accounts show net profits of 982,000 marks, against 1,060,000 marks in 1928-29; the dividend remains at 12 per cent.

The *Electricity Company* (late *W. Lahmeyer*), Frankfort-on-Main, reports net profits of 2,451,000 marks for 1929-30 as compared with 2,440,000 marks in the previous year. The dividend is maintained at 12 per cent.

Garbe, Lahmeyer and Co., Aix-la-Chapelle, state that the favourable orders received in the first half of 1929-30 were followed by a decline in the second half of the year. The accounts show a loss of 34,000 marks as compared with profits of 284,000 marks in the preceding year.

Stocks and Shares.

Tuesday Evening.

The outstanding feature of interest in the Stock Exchange markets, so far as the electrical departments are concerned, is the scheme put forward by Mr. Herbert Morrison, Minister of Transport, for the unification of London transport. The immediate effect upon market quotations was to spread a little dullness through the stocks, owing to the uncertainty felt in regard to the extremely nebulous proposition as outlined at present, added to which there is the impression, common in such cases, that Government intervention in matters of business is seldom favourable to the progress of the undertaking concerned. Underground Electric Railways has made remarkable forward strides, more particularly of recent years, and probably the company knows more about the London traffic problems than any other authority does. It is too early to say what ultimate effect is likely to be produced upon the revenues of the companies affected, and until the Government unfolds the first chapter to which the preliminary statement forms no more than a preface, it is impossible to form a judgment.

Traffic Pool Board?

Underground Electric Railways shares, which had been standing at 24s., weakened a few pence, but firmed up again to the former price, and the income bonds were left at 104. Metropolitans came down from 75 to 71½, from which there was a recovery to 72¼. The other stocks in the group show no quotable changes, and the prior-charge issues are, if anything, rather firmer than they were before. The reason for the strengthening of the latter class resides in the expectation that if the Government should take over the traffic pool as a single entity, some fresh Board will be formed on the lines of the Central Electricity Board or the Port of London Authority, and, in exchange for existing stocks, fresh securities will be offered, bearing an indirect Government guarantee. It is possible, of course, that fuller information will be available before these lines are translated into print, and keen interest awaits whatever news the Government may have to give to stockholders.

London Electric Railway.

Meanwhile, immediate attention has been focusing upon another offer of London Electric Railway 5 per cent. debenture stock, part of the same issue, that is to say, which was made in the spring at 97½. Conditions in the money market have changed very much since this stock was offered, and, in view of the present-day appetite for gilt-edged investments, the price is now 99¼. According to the terms of the issue, the Treasury has approved of the payment of grants half-yearly at the rate of 3 per cent. per annum for a period of fifteen years from March 31st, 1931, on the actual amount expended on the construction of the new works and on equipment. The new issue is for £3,400,000 London Electric 5 per cent. debenture, and £890,000 Central London Railway 5 per cent. debenture, the stocks being dated in each case 1985-1995. There has been a tremendous rush for the stock on the part of the stags. The July issue, it may be recalled, was heavily over-subscribed; applicants then received no more than 10 per cent. of their subscriptions. The price of the earlier scrip opened at ⅝ premium, and by steady degrees rose to 4 premium, from which it has come back to the present price of 3¼ premium, the reaction being due, of course, to the advent of the second amount of the stock offered this week.

Home Electricity Supply.

The County of London Electric Supply Co. has notified the holders of its 7 per cent. redeemable debenture stock that it will redeem the stock at the beginning of April next year. This is in accordance with the anticipation mentioned in these paragraphs last week. The company has made no reference so far to any further issue that may be made in order to replace the stock which is to be redeemed, and the total amount of which is half a million pounds. The price for some time past has been standing about 102¼. Assumption had taken it for granted that the County Company would duly exercise its right to repay the stock at the earliest date on which this could be done.

The price of County ordinary shares is 6d. lower at 46s. 3d. Midland Counties are 1s. down at 27s., by reason of the new issue of shares at 24s. Metropolitan Electrics are a shade lower at 2 1/32. The late Lord Birkenhead was chairman of the Greater London and Counties Trust, the semi-private company which has been of late years so active in its attention to electricity supply companies in this country. The Metropolitan is one of those which, according to rumour, was coveted by the Greater London and Counties Trust, though no definite steps have been taken towards its acquisition. The dividend for last year was advanced to 10 per cent. against the 9 per cent. paid in the previous year. The North Metropolitan Electric Power Supply Company has declared an interim dividend of 4 per cent. on its ordinary shares, the money being payable on November 15th. This is at the same rate as last year's interim dividend. For the last full year the company

paid 10 per cent. The price has hardened to 47s. 6d. Newcastle and District ordinary shares are a little better at 25s. 3d., Egham and Staines remain at 29s., Isle of Thanet ordinary at 26s. 6d., Northamptons at 43s., and Richmond (Surrey) at 40s. 9d. British Power and Light shares at 14s. 6d. are slightly better than they have been.

Cables and Wireless.

Small declines have occurred in the nominal prices of Cables & Wireless preference and "B" ordinary stocks. The market has settled down into a quiet condition, and until the traffics give some indication of improvement, it is not unreasonable to consider that prices are likely to remain very much as they are now. Proprietors are reluctant to sell, and, if the traffics should show improvement, it is as likely as not that speculation will busy itself both with the 5½ per cent. preference stock and the "A" ordinary. The former yields nearly 7½ per cent. on the money at 73½, but there is none too great a confidence felt with regard to the immediate security for the stock. The cover behind its interest service is known to be slender. The outlook for the prices depends, it seems almost superfluous to say, upon general conditions of trade. When these improve, any demand coming into the market for the stock will find little available supply. Globe ordinary continue heavy at 14½. Marconi Marines rose 1s. 9d. to 37s. 6d. upon investment buying. The Anglo-American group retains its improvement. American Telephone and Telegraph at 207½ has shed 2½ points, and Internationals at 32½ are 2 down. Automatic Telephones are a good spot, rising to 33s. 9d.

New Telephone Company.

Particulars are published of the formation of a new telephone manufacturing and concessionary company in New York. It is to be called the General Telephone and Electric Corporation, and is organised by Theodore Gary & Company and British telephone interests. The primary object is stated to development of the business outside the United States of Associated Telephone & Telegraph, and the company is an alliance of British, Canadian and American telephone concerns.

American utilities are very depressed. Radio Corporations at 25½, are about a hundred points below the level they reached last year. Power Corporation of Canada have fallen, this week, to 59½, Shawinigan Water to 64½. Consolidated Gas and Electric of Baltimore to 116½, British Columbia Power "B" to 37, and the "A" shares to 13½. New York has been on the verge of semi-demoralisation, and has offered stock with both hands.

Investment Stocks.

G.E.C. debenture, which came out at 98, has risen to 1 premium, and Edmundsons' debenture is up to 3¼ premium. The recent issue of Newcastle-on-Tyne 5 per cent. debenture is better at 5¼ premium. Tokyo Electric 6 per cent. bonds have risen to 95. The Yorkshire Electric Power Company proposes to offer £550,000 new 5 per cent. redeemable debenture stock in exchange for the existing 5½ per cent. debenture stock. This would be part of the two million pounds stock which the company has taken powers to offer. Shropshire 5½ per cent. debenture is 2 higher at 103. A similar advance lifted Oriental Telephone 4 per cent. debenture to 79½. British Electric Traction 5 per cent. debenture is up to 96½.

Brazilians and the Revolution.

The prices of Brazilian issues have been acutely flat by reason of the revolution which has broken out in the Republic. Brazilian bonds have fallen anything between 2 to 15 points. The railway stocks have suffered severely, and Brazilian Tractions at 31 show a drop of 3 points. Other Brazilian Tramway descriptions are less affected. San Paulo Tramway, Light & Power 5 per cent. debenture stock fell 1, to 84½. Rio Tramway 30-year 5 per cent. gold bonds are steady at 103, the 5 per cent. 50-year mortgage bonds being quoted lower at 86½. Anxiety prevails as to what is happening in Brazil. Anglo-Argentine Tramways and other Argentine stocks and shares hold most of their recently acquired strength, the only alteration being a reaction of 1/16 in Anglo-Argentine Tramways first preference shares, which has lowered the price to 2 7/16.

Manufacturing and Equipment.

The fresh bout of weakness which seized upon the New York market led to a weakening of a number of American industrials, and, in sympathy, Associated Electrical Industries ordinary shares eased off to 22s. G.E.C. preference, on the other hand, are better at 24s. 3d. Siemens ordinary have gone back to 1 1/16. There are a few hundred of the company's preference shares on offer at 32s., at which price the yield on the money comes to £6 3s. 5d. per cent. The group as a whole exhibits a tendency to droop, and no improvement has followed upon the declines that took place a week ago. English Electrics drooped to 12s. Babcock & Wilcox have declared an interim dividend of 7 per cent. tax free, the same as the rate of a year ago. This was considered distinctly encouraging, but it had no effect upon the price of the shares. Vickers are a dull market at 7s. 3d.

Share List of Electrical Companies.

Home Electricity Companies.

	Nom.	Approx. Dividend. 1928.	1929.	Price Oct. 7 1930.	Rise or fall	Yield p.c.
	£					
Bournemouth and Poole	1	15	15	58/9	—	5 2 0
Brompton Ordinary	1	8½	8½	26/6	—	5 5 8
Charing Cross Ordinary	1	8½	8½	28/-	—	5 0 0
do. do. 4½% Pref. ...	1	4½	4½	18/-	—	5 0 0
Chelsea	1	8¼	8¼	27/-	—	5 3 8
City of London	1	10	10	33/9	—	4 8 1
do. do. 6% Pref.... ...	1	6	6	23/6	—	5 2 2
Clyde Valley	1	8	8	37/6	—	4 5 4
County of London	1	7	10	46/3	—6d.	4 6 6
do. do. 6% Pref.... ...	1	6	6	23/6	—	5 2 2
Edmundson's 7% Pref.	1	7	7	24/-	—	5 16 8
Elec. Supply Corporation	1	11	11	47/-xd	—	4 13 7
Kensington Ordinary	1	8	8	27/-	—	5 3 8
Lancs. Light and Power	1	7½	7	24/-	—	5 16 8
London Electric	1	8½	9	30/-	—	4 13 4
Metropolitan	1	9	10	2 3/32	—3/32	4 18 6
do. 4½% Pref.	1	4½	4½	17/-	—	5 6 0
Midland Counties	1	6½	7	27/-	—1/-	5 3 8
Mid. Elec. Power	1	15	8	30/9	—	5 4 1
Newcastle-on-Tyne Ordinary ...	1	6	6	23/9	—	5 1 1
do. 7% Pref.	1	7	7	26/-	—	5 7 8
Notting Hill 6% Pref.	10	6	6	10½	—	5 11 4
North Met. Elec. 6% Pref.... ...	1	6	6	23/6	—	5 2 2
St. James' and Pall Mall	1	8	8	27/6	—	5 1 10
Scottish Power	1	8	8	28/6	—	5 12 4
South London	1	8½	8½	27/-	—	5 8 8
Urban Ordinary	1	7	7	28/9	—	4 17 5
Westminster Ordinary	1	8¼	8¼	27/6	—	5 1 10
Whitehall Elec. Invst. 7½% Pref....	1	7½	7½	24/6	—	6 2 5
Yorkshire Elec.	1	8	8	31/3	—	5 2 5

Home Rails.

Central London Ord. Assented ...	Stock	4	4	78	—	5 2 7
Metropolitan	,	3½	4	73	+3	5 9 7
do. District	,,	4	5	72½	—2½	6 18 0
nderground Electric	£1	7	8	24/-	—	6 13 4
do. do. Income ...	Bonds	6	6	104	—	5 15 5

Telegraphs and Telephones.

Anglo-Am. Tel. Pref.	Stock	6	6	101½	—	5 17 1
do. Def.	,,	1½	1½	25	—	6 0 0
Automatic Telephone	1	10	12½	33/9	+1/8	7 8 4
Cables & Wireless 5½ Pref.... ...	Stock	—	5½	73½	—1	7 9 8
do. A 7½ Ord.	,,	—	23½	25½	—	... ...
do. B Ord.	,,	—	—	12	—⅛	... ...
Globe Tel. and T. Ord.	10	10	10	14½	—	*3 18 0
do. do. Pref.	10	6	6	10½	—	5 11 7
Great Northern Tel.	10	20	20	30	—	6 13 4
Marconi-Marine	1	12½	15	37/3	+1/9	8 0 0
Oriental Telephone Ord.	1	12	12	2 1/16	—	*4 18 4

Home and Foreign Trams, &c.

Anglo-Arg. Trams First Pref. ...	5	5½	5½	2 7/16	—1/16	11 5 8
do. do. 2nd Pref. ...	5	6	6	2⅛	—	14 2 4
do. do. 6% Deb. ...	Stock	5	5	61	—	8 4 0
British Electric Traction Def. Ord.	,,	5	5	1375	—50	... ...
do. do. Pref. Ord.	,,	8	8	129½	—	6 6 6
Brazil Traction	100	7	8	31	—3	6 9 0
Brit. Columbia Elec. Rly. Pce. ...	Stock	5	5	91½	—	5 9 8
London & Sub. Trac. 5% Pref. ...	1	Nil	Nil	11/-	+6d.	... ...
London United Tram Deb. ...	Stock	4	4	52½	—	7 12 4
Mexico Trams, 5% Bonds	—	5	5	57	—	8 15 6
Mexican Light Common	100	Nil	Nil	69½	—	... ...
do. 7% Pref.	100	7	7	76½	—	9 3 0
do. 1st Bonds	—	5	5	80	—	6 5 0
Victoria Falls Ord.	1	15	15	3	—	5 0 0
Yorkshire (West Riding)		Nil	Nil	5/-	—	... ...

Manufacturing Companies.

Assoc. Elec. Ord.	1	6	6	22/-	—6d.	5 9 1
Babcock & Wilcox	1	13	15	53/3	—	*5 12 9
British Aluminium Ord. ...	1	10	10	2	+	5 0 0
British Elec. Transformer Pref. ...	1	7	7	9/9	—	... ...
British Insulated Ord.	1	15	15	3½	—	4 5 9
Brush Ord.	Stock	10	10	105	—	9 10 6
Callenders	1	15	15	3 5/8	—	4 10 8
do. 6½% Pref.	1	6½	6½	25/-	—	5 4 0
Crompton Parkinson Ord.	5/-	—	80	20/-	—	7 10 0
do. 8% Pref.	1	8	8	25/9	—	6 4 3
Edison-Swan 1st. Pref.	1	7½	7½	26/3	—	5 14 3
do. 5% Deb.	Stock	5	5	84½	—	5 18 4
Electric Construction	1	5½	5	12/-	—	8 6 8
Enfield Cable Ord.	1	20	25	4½	—	5 17 8
English Electric	1	Nil	Nil	12/-	—6d.	... ...
do. do. Pref.	1	8	Nil	8/9	—	... ...
Gen. Elec. Pref.	1	6½	6½	24/3	+6d.	5 7 2
do. Ord.	1	10	14	47/6	—	5 16 0
Henley	1	25	30	5 1/8	—	5 3 1
do. 4½% Pref.	5	4½	4½	4½	—	5 6 0
India-Rubber	1	Nil	Nil	7/6	—	... ...
Johnson & Phillips	1	10	10	13	—	5 6 8
Siemens Ord.	1	7½	7½	1 7/16	—2d.	7 1 2
Telegraph Construction	12	10	10	19	—	*6 6 7

Dividends paid free of Income Tax.

Canadian Overseas Electrical Trade.

Large Increase in Imports of American Products.

THE following figures, showing the imports into and exports from Canada of electrical and similar materials during the year ended March 31st, 1930, are taken from the recently-issued trade statistics. Figures for the year 1928-9 are given for purposes of comparison, and notes of any increases or decreases have been added :—

Imports.

	1928-29. Thou. $	1929-30. Thou. $	Inc. or dec. Thou. $
Copper wire, plain, tinned, or plated—			
Total	213	293	+ 80
From United Kingdom	13	44	+ 31
,, United States	200	248	+ 48
Copper wire, covered, including cable—			
Total	757	779	+ 22
From United Kingdom	77	178	+ 101
,, United States	676	595	− 81
Electric batteries, primary—			
Total (mainly from United States)	90	121	+ 31
Electric batteries, storage—			
Total	632	610	− 22
From United Kingdom	319	313	− 6
,, United States	312	296	− 16
Electric fans—			
Total (mainly from United States)	138	222	+ 84
Electric fuses, fuse plugs, and cut-outs—			
Total (mainly from United States)	294	275	− 19
Lightning arrestors, choke coils, &c.—			
Total (mainly from United States)	80	136	+ 56
Rheostats, controllers, &c.—			
Total	756	858	+ 102
From United Kingdom	56	72	+ 16
,, United States	700	769	+ 69
Sockets, outlets, and receptacles—			
Total (mainly from United States)	353	359	+ 6
Spark plugs, magnetos, and other ignition apparatus—			
Total	1,109	1,175	+ 66
From United States	1,081	1,148	+ 67
,, United Kingdom	15	14	− 1
Electric cooking and heating apparatus—			
Total	384	525	+ 141
From United Kingdom	1	6	+ 5
,, United States	380	516	+ 136
Dynamos and generators—			
Total	1,557	2,487	+ 930
From United Kingdom	294	534	+ 240
,, United States	1,249	1,805	+ 556
,, Sweden	1	113	+ 112
Electric lighting fixtures—			
Total	1,103	1,182	+ 79
From United Kingdom	20	37	+ 17
,, United States	1,041	1,085	+ 44
Electric meters—			
Total	408	393	− 15
From United Kingdom	41	55	+ 14
,, United States	365	335	− 30
Arc lamps—			
Total (mainly from United States)	29	48	+ 19
Incandescent lamps—			
Total	190	240	+ 50
From United Kingdom	3	3	—
,, United States	76	151	+ 75
,, Germany	14	1	− 13
,, Japan	67	15	− 52
Self-contained lighting sets—			
Total	93	76	− 17
From United Kingdom	3	4	+ 1
,, United States	90	72	− 18
Electric motors—			
Total	4,306	4,649	+ 343
From United Kingdom	548	620	+ 72
,, United States	3,599	3,889	+ 290
,, Sweden	117	85	− 32
Switches, switchboards, circuit breakers, and parts—			
Total	1,613	2,784	+ 1,171
From United Kingdom	64	328	+ 264
,, United States	1,536	2,449	+ 913
,, Switzerland	12	5	− 7
Telephone instruments—			
Total	1,855	2,858	+ 1,003
From United Kingdom	216	229	+ 13
,, United States	1,638	2,629	+ 991
Transformers—			
Total	483	817	+ 334
From United Kingdom	18	111	+ 93
,, United States	447	648	+ 201
Radio valves—			
Total	247	580	+ 333
From United Kingdom	26	29	+ 3
,, United States	447	551	+ 104
Radio apparatus, n.o.e.—			
Total	5,692	9,976	+ 4,284
From United Kingdom	90	74	− 16
,, United States	5,602	9,869	+ 4,267
Telegraph instruments—			
Total	493	752	+ 259
From United Kingdom	17	111	+ 94
,, United States	447	647	+ 200
Electrical apparatus, n.o.e.—			
Total	4,870	6,489	+ 1,619
From United Kingdom	189	175	− 14
,, United States	4,626	6,181	+ 1,555
*Total electrical apparatus**	26,775	37,611	+10,836
From United Kingdom	1,927	2,727	+ 800
,, United States	24,411	34,177	+ 9,766
Electric vacuum cleaners—			
Total (mainly from United States)	172	270	+ 98

Exports.

	1928-29. Thou. $	1929-30. Thou. $	Inc. or dec. Thou. $
Batteries, telegraph and telephone apparatus—			
Total	627	762	+ 135
To United Kingdom	23	33	+ 10
,, United States	22	43	+ 21
,, Newfoundland	27	30	+ 3
,, Australia	12	6	− 6
,, New Zealand	259	286	+ 27
,, Cuba	33	5	− 28
,, Brazil	118	192	+ 74
Dynamos, generators, and motors—			
Total	51	41	− 10
To United Kingdom	22	7	− 15
,, United States	13	18	+ 5
Electric cooking and heating devices—			
Total	653	766	+ 113
To United Kingdom	21	14	− 7
,, New Zealand	295	320	+ 25
,, Australia	95	172	+ 77
Sparking plugs, magnetos, &c.—			
Total	450	460	+ 10
To United Kingdom	152	157	+ 5
,, Australia	117	118	+ 1
,, India	38	48	+ 10
,, Japan	39	19	− 20
,, New Zealand	41	48	+ 7
Electrical apparatus, n.o.e.—			
Total	610	493	− 117
To United Kingdom	79	64	− 15
,, United States	48	40	− 8
,, Australia	73	11	− 62
,, Japan	38	44	+ 6
,, Mexico	89	89	—
,, Newfoundland	15	36	+ 21
,, New Zealand	78	108	+ 30
*Total electrical apparatus**	2,401	2,521	+ 120
To United Kingdom	299	274	− 25
,, United States	95	107	+ 12
Electric vacuum cleaners—			
Total	1,698	2,067	+ 369
To United Kingdom	1,127	1,427	+ 300
,, Germany	326	294	− 32
,, New Zealand	136	127	− 9

* Not including vacuum cleaners.

Underground Chamber Ventilation.

Details of the "Savonius" rotor ventilator, and of its application to a distribution chamber in Glasgow.

By JOHN H. GARTY.

THE efficient ventilation of underground chambers is a problem which demands the closest investigation by our engineers, as the necessity for solving the difficulty has become acute. Congested pavements require that junction boxes and similar impediments to space and outlook should be removed, as they are fast becoming a danger to pedestrian and driver alike. The obvious place to re-install these is underground, but the difficulty is that to-day the

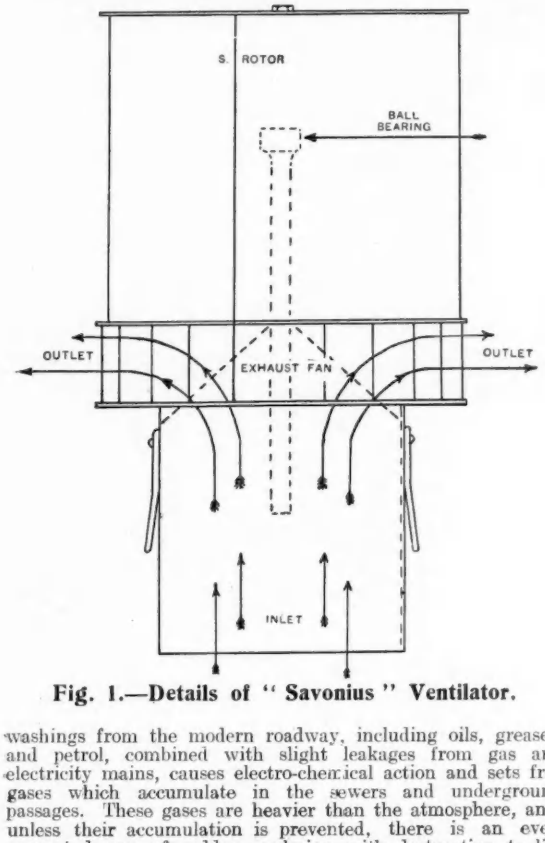


Fig. 1.—Details of "Savonius" Ventilator.

washings from the modern roadway, including oils, greases, and petrol, combined with slight leakages from gas and electricity mains, causes electro-chemical action and sets free gases which accumulate in the sewers and underground passages. These gases are heavier than the atmosphere, and, unless their accumulation is prevented, there is an ever-present danger of sudden explosion with destruction to life and property. It is therefore essential that any chambers and passages constructed underground should have positive means of through ventilation of sufficient force to remove these gases. There is also the problem of condensation to be overcome, say, in the cases of underground chambers being used for electrical junction boxes or traffic signalling.

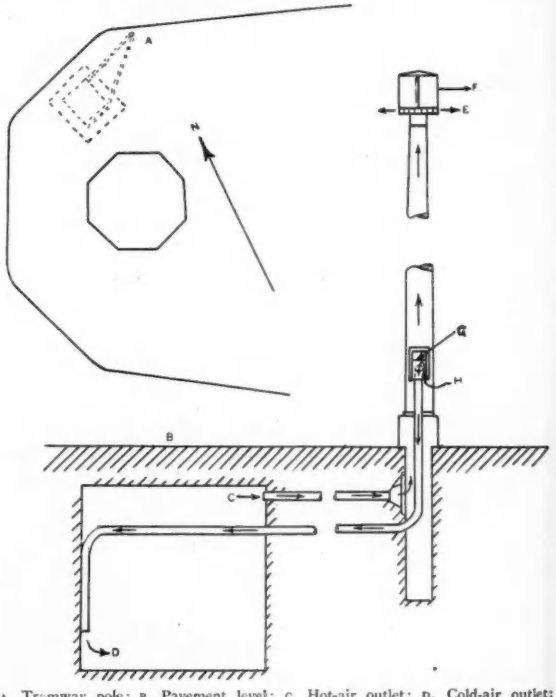
A very efficient solution to condensatic trouble, by means of the "Savonius" rotor ventilator, was demonstrated recently. In the hub of Glasgow (Glasgow Cross) has been erected a reproduction of the ancient historical Mercat Cross. Radiating from the Cross are five main roads, each of which has a double set of tram lines and very heavy vehicular traffic. Surrounding the Mercat Cross Island modern steel and stone buildings about 100 ft. high have been built under the town improvements scheme. It was decided that the only way to house the electric cable junction boxes, &c., in the area was by means of an underground chamber. This decision was, I understand, arrived at very reluctantly, for it was anticipated that condensate troubles were likely to result. In conjunction with the engineers of the Glasgow Corporation Electricity Department, however, it was arranged for ventilation to be effected by leading a tube from the chamber to the nearest tramway standard. A "Savonius" patent wind rotor ventilator was erected on top of a pole, so as to draw air from the chamber through the connecting duct up the pole, and discharge it to atmosphere. An inlet was provided by a similar tubular conduit, commencing under the hood at the base of the pole and continuing to the opposite side of the chamber. The chamber, which was constructed of solid concrete, with a manhole watertight door, was approximately 7 ft. by 7 ft. by 6 ft. high. It is obvious that in most situations a tramway standard would not be necessary, as an ordinary soil ventilating pipe could be used and run up the nearest building, with a "Savonius" ventilator erected at the top.

Before the ventilator was installed there was a continuous accumulation of water in the chamber, the walls, cables, and fittings being coated with a film of moisture, which disappeared after the apparatus was fitted and the chamber became and kept perfectly dry.

When testing the installation under ordinary weather conditions it was estimated that the wind at the house tops was about 15 miles per hour, while the whirling wind about 30 ft. from the street was about 10 miles per hour. The ventilator, with the man-hole door closed, drew up 15.5 cu. ft. of air per minute, which changed the air in the chamber a little over three times per hour. This was considered ample, as these figures could be taken as a fair average for each hour over a twenty-four-hour day.

The "Savonius" ventilator is comparatively new in this country, although it has been rapidly developed and adopted on the Continent. Briefly, it consists of two S-shaped vanes placed between upper and lower disks. Below the lower disk is built a centrifugal-type fan, and the whole is supported on a ball-bearing steel spindle. The rotors have been developed and are marketed in this country by the Glasgow Electrical Engineering Co., Ltd.

Fig. 1 shows a "Savonius" wind rotor assembled as described. It should be noted how the air is drawn up through the inlet and discharged through the fan blades, the rotor blades or vanes providing the motive power to drive the fan. The ventilator is adaptable to practically every class of ventilator work, whether for free ventilation, or where air is to be drawn through ducts, and with slight modifications it also



A, Tramway pole; B, Pavement level; C, Hot-air outlet; D, Cold-air outlet; E, Exhaust fans (hot-air outlet); F, Wind rotor; G, Hood; H, Cold-air inlet.

Fig. 2.—Ventilation Arrangements for Underground Chamber.

applies to the ventilation of ships. Fig. 2 depicts the general arrangement of the underground chamber and tramway pole, with the inlet and outlet connecting ducts.

It is a curious fact that rotors above 12 in. in diameter never seem to stop rotating. The rotors, being irreversible, absorb any power derived from wind eddies created by buildings. The ventilators have an extensive use in all ventilation problems, but especially these problems that arise with underground chambers and tunnels.

Electricity Supply Salesmanship in the U.S.A.

Extracts from the second report by Lieut.-Col. W. A. Vignoles, Director of the E.D.A., on his visit to America.*

Service, Advertising, and Salesmanship.

QUITE as much attention is paid to planning methods of selling electricity as to the design of power stations, and, although large numbers of undertakings do not encourage, to any great extent, the use of electricity for cooking, and fewer still encourage the use of electricity for heating, yet it would appear that the average sale of electricity per domestic consumer in the States exceeds that in Great Britain. According to the latest figures available, the average sales per domestic consumer in the States amounts to 624 kWh per annum, the average price being 3.03d., and the average annual bill per consumer £6 12s. 6d. Unfortunately, such figures are not available for Great Britain, as in the returns submitted by undertakings to the Electricity Commissioners, domestic supplies are merged with general lighting for commercial and other purposes, the average price for these purposes being 3.05d. per kWh; this figure can be compared with the figure of 3.03d. per kWh mentioned above, but the difference in the value of money in the two countries must be borne in mind.

It must also be remembered that the figures for the United States are based on supplies to about 70 per cent. of the total number of homes, and that, therefore, the figures are an average over many classes of the population, and not only for well-to-do homes.

In Great Britain the number of domestic consumers has now reached about 2,600,000, or about 25 per cent. only of the total; it may be noted that there are already nearly two million telephone subscribers in Great Britain, while the number of people whose income is above the lowest taxable limit is over 4½ millions. The average kWh sold per consumer in the U.S.A. has increased between 1922 and 1929 by no less than 40 per cent. Supply undertakings, after having secured practically 100 per cent. of possible consumers in their areas of supply, have devoted special attention to increasing the average sale per consumer, without selling electricity for heating or cooking.

Factors Affecting Development.

The following are special factors in the U.S.A. :—

1. The use of overhead lines.
2. The large percentage of possible consumers already connected.
3. The low price of electricity for lighting.
4. The low price of lamps.
5. The absence of serious competition from gas in the lighting field.

Not only is electricity cheap, but the public has also realised that it is so, at least so far as lighting is concerned; no propaganda is required on this point, but efforts are being made to get the public to realise that electricity for other purposes is as cheap as it is for lighting. Similar development has been going on in the use of electricity in industry, the total kWh generated by undertakings having increased between 1922 and 1929 by 126 per cent., notwithstanding the previous great development, while the number of domestic and farm consumers has increased by 96 per cent., and commercial consumers by 70 per cent. There appears to be no sign at present of any approach to saturation, the percentage increase (in kWh generated) between 1922 and 1929 being very little below that recorded in Great Britain in the same period (140 per cent.).

In the course of my tour I visited the electrical undertakings in New York, Philadelphia, Washington, Cleveland, Chicago, Los Angeles, San Francisco, Detroit, Toronto, and Montreal, and had the opportunity of studying the records of, and the service and selling methods adopted by, these undertakings.

Ideal of Service.

The ideal of service to the consumer is now held very generally in America. It is considered that a supply undertaking has by no means done its job when it has delivered electricity to a consumer's premises, and that a consumer has not an adequate service unless he has the means of utilising, and has been educated to use, electricity intelligently for lighting purposes, and is also advised as to the many other uses that he can make of the supply.

Customers will appreciate highly a service which will at any moment of the day or night attend to his fuses and put into operation again the flat-iron, the flexible cord of which has given a little trouble, or the cooker, or cure some other defect, possibly of a minor character, which has brought work, whether it be in the house or the factory, to a standstill. The speeding up of the first connection of a consumer is also service which will often be highly appreciated. The foundations of a sound and progressive electricity-supply business must rest on a basis of good service, creating contented consumers.

It is necessary to employ staff to give such a service, but this is not all money out of pocket, as this staff will, while helping the consumer, assist in creating a much greater demand for electricity.

Advertising.

Service must be backed by advertising. The supply undertakings of America, in addition to supporting the National Electric Light Association, the Society of Electrical Development, and perhaps a local league, themselves advertise extensively in the public Press and in other ways.

Owing to the enormous volume of general advertising that comes before the American public, advertising must be very forcible and of considerable volume to be effective.

As to the expenditure which should be incurred by each undertaking for advertising its products, the figure I have usually recommended of one per cent. of the gross revenue from electricity supply appears to be less than the amount usually incurred by undertakings in America for this purpose.

Salesmanship.

A great deal of work which can be classified as salesmanship may also be called service; thus, practically every undertaking in America has a lighting department with an adequate staff of lighting engineers ready to advise the prospective consumer on the lighting installation he should put in.

Details are given of the sales organisation of an undertaking supplying an area with a population of about one and a quarter million, with a total sale of 1,500 million kWh per annum.

Sales to residential consumers have risen from 513 kWh in 1926 to 642 kWh per consumer for the year ended April, 1930. This is substantially above the average for the whole country. This undertaking—like most undertakings in the U.S.A.—does not encourage the use of electricity for heating, and has done very little towards developing electric cooking in private houses or apartments. It has, however, made great progress in developing electricity for lighting, refrigeration, washing, and for small appliances.

It might be as well to note that the residential tariff, as is frequently the case in America, is on the "block" system; the rate per kWh is 2½d. for 480 kWh per annum, 2d. for the next block of 2,400 kWh per annum, and 1.4d. for all in excess of 2,840 kWh per annum. I was informed, however, that the 2½d. rate was really too low for the small consumer, and that there should be a block at 3½d. to 4d. per kWh.

All accounts, as is usual in America, are rendered monthly; notwithstanding the additional cost of reading meters and rendering accounts, this system, owing to its many, and substantial, advantages, is generally preferred.

The company employs a large sales staff, the cost of this department amounting to nearly £50,000 per annum (about one per cent. of the gross revenue).

The undertaking has secured practically 100 per cent. of the possible connections in the area, including industrial ones; very few small private installations are left, and none appear to be going in.

Organisation of Staff.

The sales staff of this undertaking is divided into groups of specialists.

(*a*) Lighting falls under district representatives, who also deal with all small inquiries in their districts, turning in orders for something like 300 kW of connections each week.

* For First Report by the Director, see ELECTRICAL REVIEW, July 25th, 1930, pp. 125 and 160.

(*b*) Heavy-duty cooking, as distinct from domestic cooking, has been developed to a considerable extent. The specialists in this department have studied the whole business of the hotel man, so as to be able to talk to the consumer in his own language. Some hotels are using nothing but electricity; two restaurants, one cooking a thousand and another two thousand meals per day, and a large hotel are completely electrified, while a number of outlying country clubs are found to offer good opportunities for the sale of electricity for this purpose.

(*c*) Industrial heating is divided into sub-groups dealing with the heat-treatment of steel processes, non-ferrous metal works, and general purposes. The men employed are technical engineers who have specialised in industrial heating, and who have been trained for this work.

(*d*) Two men specialise in street lighting, and these conduct negotiations with municipalities in connection with all schemes and suggestions for improved lighting.

(*e*) One man is employed on electrical advertising signs.

(*f*) One man specialises on applications of the use of electricity in printing.

(*g*) One man deals with electric transportation in the street and in factories.

(*h*) One man specialises entirely in new office buildings, schools and churches, maintaining contact with architects.

(*i*) Three men are employed on general work, including major industrial jobs.

The company also at times finds it necessary to employ consulting engineers to prepare schemes for consumers.

Everything possible is done to create a demand for the product that is for sale, and the same men keep in touch with consumers after they have been connected up, and advise the consumers on alterations they contemplate or that the undertaking thinks they should consider.

This organisation is maintained entirely to sell electricity; the undertaking does not itself sell any apparatus, and although there is an active Electrical League, affiliated to the Society of Electrical Development, carrying out co-operative propaganda work, the League also does not sell to the public. This, however, does not seem to have been any disadvantage to the industry, as the gross sales by dealers, distributors, drug stores, departmental stores, &c., of electrical merchandise (*i.e.*, small apparatus usually sold from shops) in this area in 1929 amounted to over £3,300,000 ,a very wonderful result in an area with a population of less than 1¼ millions.

The percentage of the total represented by each class of apparatus was as follows: radio sets and parts, 35.1; refrigerators, 18.6; washing machines, 15.6; lighting fittings, including portable lamps, 9.4; toasters, percolators, irons, ironing machines, heaters, grills, and cookers, 5.7; vacuum cleaners, 5.3; wiring supplies, 3.7; incandescent lamps, 3.4; sewing machines, 2.2; fans, 0.5; and small motors for home use, 0.5.

In concluding this report I would like to acknowledge the great help and assistance given to me while in the States by the director and staff of the National Electric Light Association, by the director and staff of the Society of Electrical Development, and, indeed, by everyone that I met connected with the industry.

A Novel Thermal-storage Scheme.

At the Strangers' Hall, Norwich, an old tiled floor is used to warm the building on the thermal-storage principle.

STRANGERS' HALL, a 15th-century mansion in Norwich which is now used as a folk museum, possesses a very interesting and perhaps unique heating installation. It was very desirable to preserve the medieval aspect of the building and to make the heaters as inconspicuous as possible; "Heatrae" low-temperature air warmers and hot-pipes were adopted. Whilst this was, in the main, satisfactory, difficulties were experienced on account of the large and lofty banqueting hall, because of its tiled floor, which kept the temperature abnormally low. To deal with this, a method of floor heating has been carried out. The floor of the hall is very thick, as it forms the vaulted stone roof of a crypt. It was decided to use this floor on the thermal-storage principle, and the floor was taken up and relaid in the following manner. A row of 12 asbestos tubes 15 ft. long, 3 in. diameter, containing heating elements, was laid 6½ in. below the level of the floor and 18 in. apart. The spaces between the tubes were filled in with large pebbles, and mortar 1½ in. thick was laid on. This was followed by approximately 1 in. of cement, and the tiles were then carefully replaced.

The heaters, each of 750 watts loading (supplied by Electric Fires, Ltd.), are run two in series on 440 V, and they are divided into three groups, each controlled by a double-pole fused switch, the whole being controlled by a time switch. Current is automatically switched on at night and off again in the morning. It is found that with an out-door temperature of 45 deg. F., the floor in the morning, after nine hours, has a temperature of approximately 67 deg. F., sufficient heat being retained to prevent the floor temperature falling below 62 deg. F. during the day. The ends of the heating tubes are brought out into a passage running beneath the hall, so that the elements may be readily withdrawn in case of failure, though this is not likely to occur with the low current densities employed in the elements.

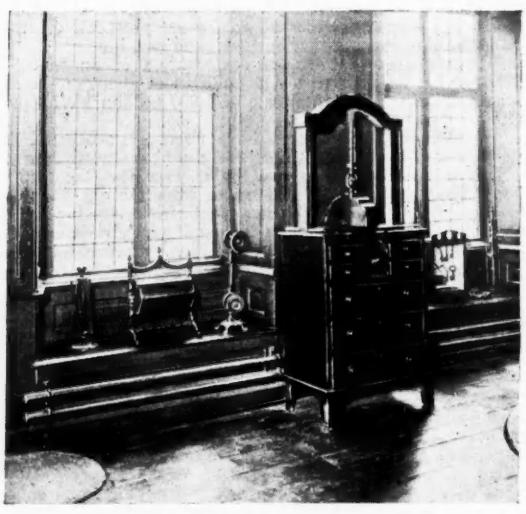


Fig. 1.—Tubular Heaters in Strangers' Hall, Norwich.

Fig. 2.—Air Warmers in Rush-floor Dining Room.

Figs. 1 and 2 are views in one of the upper rooms and the rush-floor dining room, showing, respectively, low-temperature tubular heaters and air warmers.

We are indebted to the city electrical engineer, Mr. F. M. Long, and the sales engineer, Mr. A. C. Green, of the Norwich electricity undertaking, for the above information and photographs.

Kinema Power Plant.

Notes on electrical power plant for talking-film equipment, and methods of obtaining constant-speed drives for projectors.

FREEDOM from irregularities in the speed of kinematograph projectors is recognised as being of the first importance in the successful operation of both silent and talking-film equipment.

Having investigated the problem in all its aspects, the British Thomson-Houston Co., Ltd., developed for kinema use full ranges of projector motors and combinations of machines which may be required for providing steady supplies of electrical energy for the projector motors.

Projector Motors.—There are several favoured methods of driving projectors. Among them are d.c. motors of either the shunt- or compound-wound types, or even special motors fitted with some form of speed-governing device. Again a.c. 50-cycle synchronous, repulsion-induction, or split-phase induction motors may be used. On the one hand, the advantage of using the synchronous type is that of constant speed, even though the supply voltage and the load may vary. On the other hand, the repulsion-induction and split-phase induction types require a smaller starting current, but against this advantage their speed is liable to vary between the slip and synchronous speeds as the load varies. It is advisable to rate this type of machine easily, when the maximum possible variation between the full-load and synchronous, or no-load, speeds will be considerably reduced.

A synchronous motor of equal power rating is slightly more expensive than are the split-phase and repulsion-induction types, but this difference in cost is discounted by the fact that in order to rate the latter types very easily the next higher power machine should be used; in consequence, the cost goes up until the synchronous motor becomes slightly cheaper.

Universal motors, complete with turntables, suitable for any voltage and frequency are manufactured for the non-synchronous equipment usually provided for playing instrumental selections during the intervals between films, and for incidental music for silent films.

Motor-generators.—For d.c. projector motors the necessary constant-voltage supply is best obtained from motor-generator sets driven off the local mains. The generators are level compounded, so that when a second projector motor is switched on there will be no fluctuation in the supply voltage sufficient to cause any appreciable speed variation in the projector drive. The generators, usually rated at 3 or 4 kW, have been standardised, together with baseplates and flywheel couplings, so that the only special part of a set is the motor, which may be either a d.c. or an a.c. machine, according to the available local system.

Motor-alternators and Rotary-convertors.—Since some customers favour an a.c. drive for constant speed, the company has designed both motor-alternator sets and rotary convertors for the purpose, the machines of both these types being compounded, similarly to the d.c. generators, so that considerable variations in load will not greatly effect their output frequency. In the case of the ordinary type of non-compounded alternator it is impossible to obtain better voltage regulation than 15 to 20 per cent., while by specially designing the machine for use with its d.c. driving motor the variation in voltage and frequency can be cut down to about 3 per cent. when full load is suddenly switched on or off.

Double-conversion Sets.—Usually a.c. projector motors are designed for 50-cycle circuits, so that in some cases in which the local supply is not of that frequency it is necessary to install a double-conversion set. If a rotary convertor be used to supply energy to the projector motors, an a.c./d.c. motor-generator set will be required also, making three machines in all, but if a motor-alternator set be used the converting plant will comprise four machines. The a.c./d.c. motor-generator set is required in order that the field of the alternator or rotary convertor may be compounded with the line current of the d.c. driving motor or the d.c. input to the rotary-convertor, respectively. It should be borne in mind that the latter can be wound for a range of input voltages, the output being regulated and brought to the standard voltage by means of a transformer provided with taps, which arrangement allows of slightly closer regulation being obtained than is possible with a motor-alternator set, a decided advantage. When, however, the number of converting sets required is small the motor-alternator scheme will be cheaper than the rotary scheme; nevertheless, a large number of similar converting sets costs considerably less in the case of rotary-convertors and transformers than that of motor-alternators. The reason for this is that, as most types of talking-film apparatus are driven by standardised motors, the a.c. output voltages from the converting plant can be standardised, standardised alternator designs being made, and standardised motors used to drive the alternators. Thus, the cost of design will be small, while the cost of material for a quantity will be greater for motor-alternators than for rotary-convertors, whereas a new design of rotary-convertor will have to be developed for every variation of input and output required, thus giving to the motor-alternator the advantage of lower cost in single applications and small quantities.

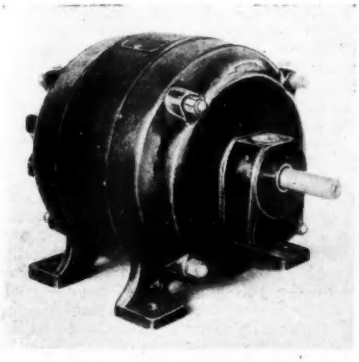


Fig. 1.—Projector Motor.

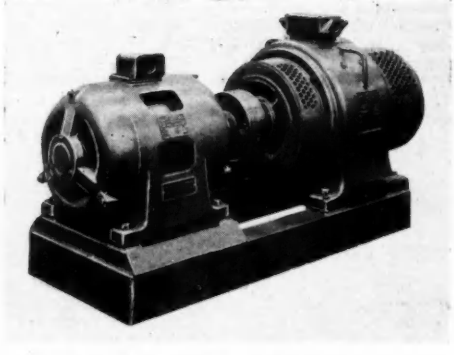


Fig. 2.—Motor-generator.

Fig. 3.—Rotary-convertor.

Generators for Arc Feeding.—For some years the company has manufactured generators and motor-generator sets for feeding projector arcs in kinemas and theatres, such plant being so compounded that the light intensity will be maintained at a constant value, and appreciable flicker will not occur during the change-over from one film reel to the next, the latter being projected from a second machine. While the double load is momentarily thrown across the terminals the voltage is maintained, and it does not rise excessively when the first projector lamp is switched off.

Exciter-lamp Generators.—A small and compact generator has been designed for supplying a steady current to the exciter lamps used for illuminating the sound track on the films of talking equipment. The output from this machine at 13 volts is 7.5 or 15 amperes, the double rating implying that when the second projector is switched on, thus momentarily doubling the load on the exciter generator, there will not be any flicker in the light emission due to the sudden drop in voltage that would occur if the generator were not specially compounded to guard against it. This likely cause of trouble will be appreciated when it is realised that a flicker of the lamp would cause an appreciable variation of the volume of the loud-speakers.

Commutation has also been seriously considered, and it is claimed to be so good that smoothing circuits are rendered superfluous, as the output is said to be so steady that no crackle due to ripple or sparking can be heard.

This machine can, therefore, be installed in replacement of batteries, which will always require charging.

Battery-charging Sets.—For those who still prefer to illuminate the sound track with battery-energised lamps the company has standardised battery-charging generator sets with a 15-volt output; charging control boards can also be supplied if desired.

Oil-engine Sets.—For kinemas in small towns and villages without public electricity supplies the necessary power is best obtained from a modern Diesel-electric generating set of 9 h.p. or over, running at about 1,000 r.p.m. Engines of this type can be started from cold by hand, no cartridge, electrical ignition, or lamps being necessary. Moreover, the cyclic variation is small and the running of the engines smooth, the former being an extremely important feature in the case of talking films, as it means that the voltage variation is kept within fine limits, while smoothness in running makes for silence in operation.

Besides supplying generators mounted on the same baseplate as, and directly coupled to, engines of this type, the company also manufactures distribution switchboards. Thus, every item of power plant needed for kinemas can be supplied by the B.T.-H. Company. Figs. 1, 2 and 3 show typical examples of the company's machines.

Institute of Fuel.

Report of a discussion following visits to the Barking and Deptford Power Stations and H.M. Fuel Research Station, Greenwich.

FOLLOWING the visits arranged under the auspices of the Institute of Fuel on September 25th to the power stations at Barking and Deptford of the County of London Electric Supply Co., Ltd., and the London Power Co., Ltd., respectively, and to H.M. Fuel Research Station at East Greenwich, a report of which was published in our last issue, an instructive discussion took place at the Institution of Electrical Engineers on the subject of the day's visits.

Mr. R. A. Chattock (late city electrical engineer, Birmingham), opening the discussion, said it was well known that good-quality coal could be burned very efficiently on mechanical stokers, and he considered that in respect of the last few years the pioneers of pulverised-fuel firing could claim a certain amount of credit, because the development they had brought about had undoubtedly stimulated the stoker manufacturers to produce stokers which were very much better in operation than those supplied, say, ten years ago. On the other hand, where poorer qualities of coal of the order of 8,000 to 10,000 B.th.u. had to be used, the burning of it on mechanical stokers was not so easy. One could not get the intense heat in the fuel bed on a mechanical stoker with the poorer coals that one could get with the better-class coals, and consequently a larger percentage of the carbon in the coal went over the backs of grates into the ash pits, and the efficiencies fell. In addition, the furnace temperature was not so high, and the efficiency was less on that account. With pulverised-fuel firing, it was practically possible to burn the poor-quality coal and to get the very utmost out of it. Although stoker-fired furnaces were being adapted, by water cooling, and so on, to allow higher CO_2 contents to be used, he feared that under those conditions trouble would be experienced with the mechanical parts of the stokers.

One of the great troubles experienced with pulverised-fuel firing was the dust problem. His experience indicated that about 40 per cent. of the material which otherwise would go up the chimney was caught by the ordinary cyclone. That was not nearly enough, of course, and he had tried placing two cyclones in series at Birmingham, with the result that a little over 70 per cent. of the material was caught. The remaining 30 per cent. still went up the chimney, but it was of such very fine texture that it was almost like smoke, and he did not think that it could cause any real nuisance in the district. There was a tremendous amount of dirt and dust at the Barking station, which he felt should not be there, although he quite appreciated that that station was not one of the most modern. Figures relating to recent months' working of the Hams Hall station showed that the coal burned per kWh sent out was 1.56 lb., and the station was running at a load of about 50,000 kW. The calorific value of the coal, as fired, was 10,280 B.th.u., and the B.th.u. per kWh sent out were 16,037. The overall thermal efficiency of the station was 21.27 per cent., and that figure took account of the operation of the turbines as well as of the boilers. The total works cost for the station over the period in question was 0.135d. per kWh.

The method adopted at Barking for the drying of the coal, by passing flue gases through the mills, hardly commended itself to him, because he did not see how it was possible to regulate the degree of drying in accordance with the varying moisture content of the coal as received, and so obtain a consistent moisture content in the resulting pulverised fuel.

Mr. J. A. Vice (County of London Electric Supply Co., Ltd.), replying to Mr. Chattock, said he was not authorised to mention costs at all. As to the relative efficiencies of the Hams Hall and Barking stations, he pointed out that whereas the Hams Hall station was a complete unit, the Barking station had stoker-fired boiler plant which was between 9 and 9½ years old in design, and other boiler plant at least four or five years old in design. The result was that there were two boiler houses with different performances. When one was balanced against the other it was found that the pulverised-fuel-fired boiler house was very much more efficient than the stoker-fired one, but it must be remembered that those conditions were domestic and did not necessarily apply elsewhere. For the six months from March to September of this year, 98 per cent. of the kWh generated had been produced from steam from the pulverised-fuel boiler house. For weeks on end the calorific value of the coal burned varied only from 10,500 to 10,700 B.th.u., and the coal figure varied from 1.4 to 1.45 lb. per kWh. That gave an overall efficiency for kWh sent out of about from 22 to 22.2 per cent. If they ran only those turbines at the end of the turbine house opposite the pulverised-fuel boiler house, the result would be still better, but generally the running turbines were distributed up and down the turbine house, with consequent losses. They were perfectly happy with their method of drying coal by means of flue gases in the mills. It was not the method of drying for which the plant was designed, but it was perfectly successful. They were perhaps fortunate in the fact that the moisture content of the coal delivered from time to time varied within comparatively small limits, from 9 to 11 per cent. With a 10 per cent. moisture content in the original coal, the content in the p.f. was reduced to from 2 to 4 per cent. Packing had occurred in the bunkers very badly indeed when there was more moisture in the pulverised fuel, but during the last 12 or 18 months it had not occurred. When a boiler was under survey and was taken down for three or four weeks it was the practice also to clean out the pulverised-fuel bunker, and on those occasions, although they did find a considerable amount of fuel adhering to the sides, it did not cause trouble by falling down and clogging the burners.

Mr. F. Bernard Kerridge, in a written communication, asked if the County of London Electric Supply Co., Ltd., could give some information as to the relative merits of p.f. and chain-grate firing, now that they had had experience with the two systems side by side at Barking. He asked also whether the problem of disposal of the p.f. ash had yet been solved. With regard to the Deptford stations, any information the London Power Co., Ltd., might be disposed to give as to the relative merits of the chain-grate and retort stokers would be very much appreciated.

Mr. Vice said he was not able to say whether powdered fuel or stoker firing was the better, and was not sure that he would be able to say definitely even two or three years hence. Owing to the difference of five years in design between the two installations at Barking, if he were to express an opinion based on his own experience it might be applied by other people to other circumstances, and their conclusions would be quite wrong. During the last two years there had been occasions on which shipments of particularly bad coal had been delivered, having a calorific value of something under 9,000 B.th.u., instead of the usual 10,400 or 10,500, and being rich in ash, but although the chemical laboratory had reported that the coal was particularly bad, the operators of the plant, when asked what had happened, had said that they were unaware that they had had such coal. Had it been used on the stoker-fired plant, he would have heard about it within an hour. He had not yet been able to find a market for the slurry. He felt that Mr. Chattock was unduly optimistic in thinking that if one extracted 80, 85, or even 90 per cent. of the ash mechanically, one could be quite happy.

Mr. A. H. Ellis (London Power Co., Ltd.) said there was very little difference between the latest type of travelling grate, as installed at Deptford, and the retort type. In both cases the efficiency was over 88 per cent. on test on the gross calorific value of the fuel, 10,500 B.th.u. The running efficiency of the grates was 85 per cent., and he considered that very good, because in the east station, where the new stokers were installed, the steam demand varied from minute to minute by between 200,000 and 300,000 lb. per hour, and the stokers had to meet that variation. In the west station there was a retort and a chain-grate stoker, and, although they had not yet been tested, in every-day working the grates were giving perfectly satisfactory results. There was also very little to choose between the two types from the point of view of repairs and maintenance. He believed one would have to go a long way before

finding cleaner stacks than those of the Deptford stations, but his company was not satisfied with its achievement in that connection and it had taken out a patent in respect of a method for the further treatment of the flue gases, which method had proved, by experiments on a large scale on actual stacks, capable of removing all traces of dust or sulphur. The thermal efficieny of the Deptford (West) station was over 23 per cent. on the kWh sent out.

Dr. C. H. Lander (director of research, H.M. Fuel Research Station) said he was familiar with the experiments referred to by Mr. Ellis with regard to the removal of grit and sulphur, and the method involved was likely to provide practically a complete solution of the sulphur problem. The grit question was far more difficult; grit could be removed practically completely—at a cost—and it was a commercial matter to a large extent, rather than a problem of actual research, unless some new principle, which he could not see at the moment, was put forward.

Mr. H. M. Ridge asked what were the temperatures at which the gas entered and left the air heaters at the Deptford and Barking stations, and whether there were any signs of corrosion in those air heaters. He understood that the temperature was below that of the dew point of sulphuric acid, and therefore he would like to know whether the acid had had any effect.

Mr. Bruce, replying, confined his remarks to the pulverised-fuel plant, because in that plant there were lower temperatures than on the stoker plant. The gases entered the air heaters at temperatures of from 320 to 375 deg. F., and left at temperatures between 250 and 270 deg. F. There had been no corrosion troubles whatever with the air heaters, and no signs of condensation in any part of the plant.

The Chairman, Sir Phillip Dawson, M.P., in summing up the discussion, said it seemed to him that, as had been the case in connection with the development of gas and electricity, so also in the case of boiler firing those interested in the different methods were inciting each other to effect improvements. He thought that both stoker firing and pulverised-fuel firing would find efficient use in the various power stations throughout the world, according to the circumstances applying in the different cases. An important factor in connection with pulverised-fuel firing, from the national point of view, was that undoubtedly it would facilitate the use of inferior fuels which could not be burned efficiently under boilers by means of stokers.

Guildford's Electricity Supply.

Report of the official opening of the 3,000-kW Extension at Woodbridge Power Station.

IT was in May, 1928, that the first section of Woodbridge power station was officially opened. The installation comprised two 1,875-kW and one 3,750-kW (m.c.r.) turbo-alternators and two boilers, each capable of evaporating 40,000 lb. per hour. These were fully described in the ELECTRICAL REVIEW of June 15th, 1928. Since that time progress has been rapid, the output in 1929 increasing by nearly 75 per cent. over the previous year. Moreover the Corporation has recently obtained sanction for a large extension to its area of supply; the added area includes the villages of Albury, Bramley, Chilworth, Peaslake, Shamley Green, Shere, and Wonersh, and the extension of the mains to the above districts is now practically complete.

The Corporation has also during the past few months entered into an agreement with the Central Electricity Board to give a bulk supply to the Board on the completion of the extension to the generating station.

The new plant, which cost about £50,000, comprises one 3,750-kW (m.c.r.) Parsons turbo-alternator, shown in the foreground of fig. 1, together with one tri-drum bent-tube vertical Stirling boiler (with an economiser incorporated) having a normal evaporative capacity of 40,000 lb. of water per hour, at a pressure of 275 lb. per sq. in. A reinforced-concrete coal bunker, having a capacity of approximately 140 tons, has been installed. The coal from the bunker is gravity fed through "Simplex" valves into coal shoots leading to the stoker hoppers. Each boiler is fitted with two heavy compartment-type chain-grate stokers, complete with force-draught fans, each grate having an area of 210 sq. ft. Working in conjunction with the boiler, and mounted on a floor above, is a "Sirocco" induced-draught fan. The switchgear is of Reyrolle manufacture, and consists of heavy iron-clad solenoid-operated switch units, with remote control panels.

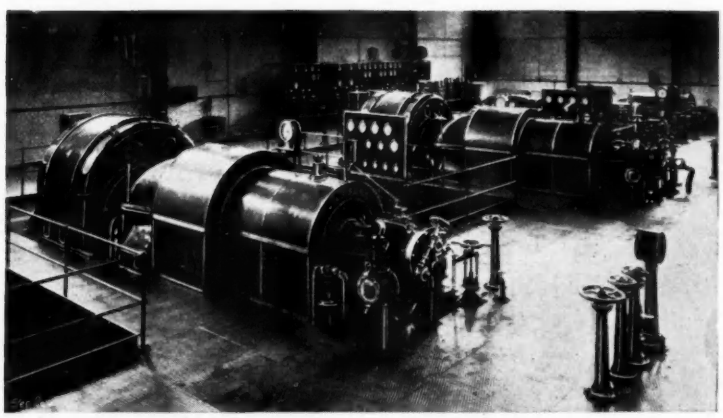


Fig. 1.—Woodbridge Turbine Room; New Set in Foreground.

The extensions to Guildford Corporation electricity generating station, which were carried out by Messrs. C. A. Parsons and Co., Ltd., were formally opened on October 1st, by MRS. J. B. RAPKINS, wife of the chairman of the Electricity Committee. The directors of the firm entertained members of the Corporation and other guests at luncheon before the ceremony. MR. S. F. PREST, a director of the firm, presided and proposed the toast of "The Mayor and Corporation."

The toast of "The Guildford Electricity" was proposed by MR. FREDK. W. PURSE, chief engineer to the London and Home Counties Joint Electricity Authority.

ALDERMAN J. B. RAPKINS, in responding, said the fact that it was only a little over two years ago that the new generating station was opened was evidence of the substantial progress that was being made. Sales to consumers during the past year exceeded 6,000,000 kWh, as against 3,500,000 kWh for the previous year. Working expenses, in spite of much higher rates, had been reduced by 0.26d. per kWh. The adoption last autumn of two-part tariffs had resulted in considerable concessions to the consumers. The average price charged was 2.18d. per kWh, a decrease of 0.71d. per kWh from the average price charged during the previous accountancy year.

At the opening ceremony Alderman Rapkins reviewed the history of the undertaking, mentioning that it was just nine years ago to that day that the Corporation took possession of the business of the old company. In the early part of last year the Central Electricity Board asked the Corporation if it could provide a bulk supply to the national transmission lines. The Corporation engineers considered that to meet the requirements of the undertaking, quite apart from any question of bulk supply, it would be necessary to provide for additional plant, and accordingly the Corporation accepted the tender of Messrs. Parsons for the extension. The maximum load in 1921, the first year the Corporation had control, was 652 kW. For the last winter a maximum of 3,430 kW was recorded. KWh sold increased from 983,000 to 6,039,718 in the same period. Of that increase some 2¼ millions were added during the year ended March 31st last.

MR. S. J. WATSON, South-East England district engineer of the Central Electricity Board, referred to the pleasant relations between the Board and the Corporation.

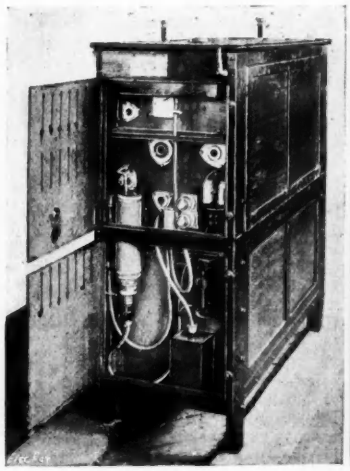
MR. G. BEDFORD, managing director of Messrs. C. A. Parsons and Co., Ltd., submitted for the acceptance of the Corporation the new plant, which was formally taken over by the Mayor, Councillor C. T. Bateman. LT.-COL. W. P. C. TENISON proposed a vote of thanks to MR. SPENCER HAWES, consulting engineer to the Corporation, and to MR. W. E. AFFLECK, borough electrical engineer, who made brief replies.

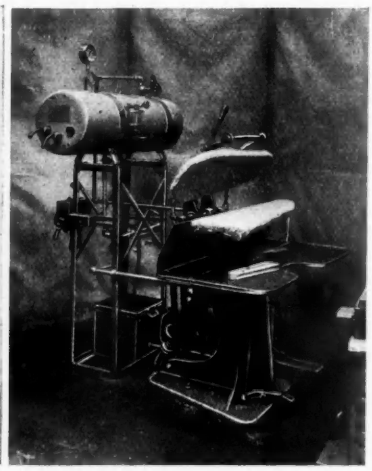
New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus for publication in this section.

Water-heating Developments.

Messrs. A. Reyrolle & Co., Ltd., Hebburn-on-Tyne, have carefully investigated the many possible applications of their immersion water-heating units to industry. One development is an equipment for supplying a small quantity of steam to a printing machine, such as is used for developing ammonia prints. It consists of an outer steel casing or jacket with a water inlet pipe near the bottom end and a steam outlet pipe at the top end. Into this jacket is fitted the immersion heater unit which is of the three-heat type. An adjustable needle valve controls the flow of water and ensures that it is maintained at a suitable level. Visual indication of this level is obtained by means of a water-gauge glass. Fig. 1 shows the apparatus fixed in position in an "Ozalid" printing machine.





Figs. 1 and 2.—"Ozalid" Printing Machine and Clothing Press fitted with "Reyrolle" Water Heaters.

Another development is a steam-raising equipment for use with a clothing press, fig. 2. The unit is supported on a suitable framework, and consists of a lagged steel cylinder into which is fitted three of the immersion heaters. The usual safety valve, pressure gauge, water-level gauge, and inspection cover are also fitted. A three-pole air-break switch is attached to the side of the framework for controlling the supply to the heaters, and a special rack is provided to accommodate any of the plugs that may not be in commission.

Fig. 3.—"Highlow" T.S. Tank.

Messrs. Archibald Low & Sons, Ltd., Merkland Works, Partick, Glasgow, W.1, are completing their line of water heaters by making the larger capacity thermal-storage tanks, fig. 3. These are made of steel riveted or welded, and to any required capacity. They can be heated by means of batteries of immersion heaters, fig. 4, bolted to flanges on the tanks, and the batteries are made up to any loadings. The construction of the heaters is briefly as follows: 2-in. dia. solid-drawn steel tubes are fixed into a heavy-steel flange drilled ready for bolting to the tank. The tubes are closed at the far end, the heating elements being arranged to slip into the tubes and provided with special heavy porcelain terminal blocks. The heating element in itself comprises heating coils of good nickel-chrome wire inside special refractory formers. The connections throughout are of the bus-bar type. The cover protecting the wiring is of steel, with glands to take the main supply cables. An alternative arrangement to the multiple-tube immersion heaters is the "Highlow" electric circulator. The tank is made up without any electrical fitments, being only provided with flow and return connections to the circulator. The circulator can also be used in conjunction with an existing coal-fired boiler system, without much alteration to the existing piping.

A further addition to the "Highlow" range of tubular immersion heaters is a series of 1¼-in. gas heaters specially designed for vertical fixing, so that there is not the least possibility of the coil sagging. These heaters were primarily designed for the New Zealand market, and they are made in loadings of 750-, 1,000- and 1,500-watt intermediate loadings; special heaters are made to any requirements.

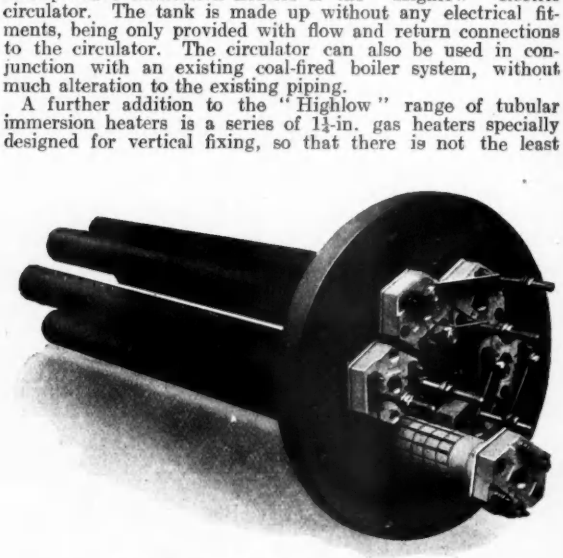


Fig. 4.—"Highlow" Immersion Heater Battery.

A New Insulating Paper.

Messrs. R. & W. Watson, Ltd., Linwood, Renfrewshire, have recently added to their insulating-paper productions a pure-rubber impregnated paper which is claimed to be water-, grease- and acid-proof, and also acid-free. It can be made in all colours. The development is the result of somewhat long and costly experiments, and is believed to be a distinctively outstanding advance in the production of rubber and paper combined.

Reviews.

Applied Mathematics for Engineers. By T. Hodgson, B.A., B.Sc. Vol. I, pp. vii+183; figs. 226. Price 9s. 6d. net. Vol. II, pp. vii+293; figs. 147. Price 13s. 6d. London: Chapman & Hall.

These two volumes deal, respectively, with the subjects of graphical statics and dynamics, the second volume containing an introductory treatment of the differential and integral calculus. These volumes are concerned entirely with the application of mathematical principles to problems in mechanical engineering, but a third volume of the series is stated to be in preparation which will deal with ordinary and partial differential equations, in which electrical problems, among others, will be considered.

In Vol. I we have an account of the vector calculus, which was presented in so attractive a way by Professor Henrici. The principles of this calculus are very clearly set out by the author, and the well-known application of these principles in giving alternative proofs of standard geometrical theorems are given. Chapter II deals with the determination of mass centres of areas and solids by graphical methods. The theory of the determination of the resultant of coplanar forces is next treated, this being followed by an elementary treatment of couples. Chapter IV explains the graphical methods of determining bending moments and shearing forces. Vector calculus theory is resumed in Chapter V, in which vector and scalar products are dealt with. Here we have further applications of the vector notation to the establishment of geometrical theorems. The concluding chapters deal with force diagrams of simple rigid frames and the principles of virtual work and potential energy.

The practical and theoretical chapters of this volume appear to bear little relation to each other. Although the principles of the vector calculus are lucidly explained, the applications of the calculus in the text seem to be practically restricted to theoretical geometry. The methods employed in the practical chapter appear to be established by the usual methods.

In the opening chapters of Vol. II, the elementary dynamical problems arising out of the motion of a point are used to introduce the rudiments of the calculus. These rudiments are then used to deal with simple problems connected with the motion of a weighty particle, and with motion in two dimensions. The two succeeding chapters deal with the calculus on conventional lines, and with its application to the usual geometrical problems, to the calculation of the maximum and minimum values of a function, and to first and second moments. More advanced problems in the dynamics of a particle are then dealt with. The last four chapters of the work are concerned with the subject of rigid dynamics, under the headings of rotation about an axis, kinetic and potential energy, and motion due to impulses. In the second volume the practical applications of the vector notation developed in Vol. I seem to be very few, and the student who works through the two volumes might reasonably consider that the vector calculus, although exceedingly interesting, had been barren so far as practical utility was concerned.

There are a large number of examples for solution by the student. Answers to most of these examples are given, but there are no answers to such problems as that of finding the forces in rigid frameworks. The work is excellently illustrated, and will be found of great interest and assistance to students of the theory of mechanical engineering who have a distinct taste for mathematics.

Seeing by Wireless (Television). By Ralph Stranger. No. 7 of the "Wireless Library for the Man in the Street." Pp. 64; illustrated. London: George Newnes, Ltd. Price 1s. net.

This is a small book that is avowedly written solely for the man in the street and its simple language fits it for such purpose. The meaning of television and its practical scope is outlined (Chap. I) and the nature of light broadly explained (Chap. II); some unwieldy calculations are set out with unnecessary minuteness, followed by a relative table which should afford much interest, as it sets out the various known ether waves.

The formation and optical working of the human eye is carefully detailed (Chap. III) and the nature of electric currents dealt with by a lengthy account of the molecular construction of matter and of the electronic theory (Chap. IV).

A lucid explanation of how sounds may be transformed into varying electric impulses is given in Chap. V, followed by an account (Chap VI) of their re-transformation (after transmission) back into sounds, and continuing (Chap. VII) with methods of transforming varying light into corresponding electrical impulses.

The basic principles of television are discussed in Chap. VIII, while Chap. IX contains a clear description of the Baird system and a brief mention of several other systems is made in Chap. X.

A very fair account of the results so far obtainable by the Baird system is set out in Chap. XI, and a somewhat prosaic future for television in Chap. XII, while in conclusion the author sets a voluntary examination paper for his readers.

The book is written with a minimum use of technical terms, the sketches and diagrams are clear but the illustrations are heavy.

In view of the little detail given in this book, the reader is therein referred to the book "Television To-day and To-morrow," which was review in these columns in the issue of May 23rd last.

Practical Transport Management. By A. Hastie. Pp. xiii+177; illustrated. London: Sir I. Pitman & Sons, Ltd. Price 10s. 6d. net.

In this country the subject of transport management represents such a new calling that it is doubtful whether it has received adequate notice so far as the writings of reputable authors are concerned. The position is very much otherwise in America, where the question has received careful and systematic study for many years. both in industrial concerns and at some of the leading universities. Signs are, however, plentiful of the increasing notice taken of the business end of transport, the Statute Book during recent years having been occupied in no small measure by comprehensive and far-reaching pieces of transport legislation connected with the movement of traffic by railway, sea carriage, air, and finally by road. All this makes the book by Mr. A. Hastie on practical transport management one of more than passing interest.

The author is the transport manager of one of the largest British manufacturing concerns, and is, in addition, an expert of widest knowledge with practical experience in more than one field of specialised transport. Having accumulated an extensive experience of practical and commercial railway operation in this country and abroad, he held an important position on the military railway organisation in the Far East during the late war.

The book necessarily approaches the problem from the point of view of the heavy industries, particularly those located in the North-East Coast area. The author is at pains to point out the growing importance of economic distribution, and indicates carefully its important bearing on profits. Considering the primary question of factory siting and layout, the field of raw materials takes up a leading position, especially in the case of an industry which requires to use a large amount of raw material in bulk, such as coal. As to the various means of transport available, it is laid down that the more alternatives in the way of access to and egress from the works, the better it is for the industry in general. Distance and cost of conveyance are, of course, of special significance where raw materials are concerned. Should rail connections be involved, the services and rail facilities likely to be available must be the subject of careful investigation between the trader and the railway company. Mr. Hastie points out that the working and facilities of docks coupled with tide connections must also be fully examined along with handling costs at the point of discharge and freight charges. According to the author, it is extremely advantageous to select a factory site which is adjacent to or on a main line railway, for, after all, railways are still the chief means of transport in this country. The question of wagon supply is affected by proximity to important railway centres and distribution points, as, undoubtedly, the nearer the works are situated to these junctions, the better chance there is of a supply of rolling stock being maintained.

Some interesting particulars are given upon the general use of mineral wagons, especially those in private ownership. It is pointed out that the average turnround of mineral wagons in this country is particularly low, being somewhere in the region of two round trips per month. All this, of course, is not consumed by actual transport, a large amount of time being occupied in standing underload, storing fuel in the wagons, and awaiting shipment instructions, so as to keep the pits going and the men in steady employment. On the question of the size of mineral wagons, the author is definitely of the opinion that larger vehicles should be introduced, stating "there is no reason why we should think in terms of a 20-ton standard fuel wagon; when a general improvement in trade takes place and financial and other considerations permit, the standard coal wagon should be at least of 40 tons carrying capacity. In fairness, however, to the British railway companies, it must be stated that apart from wagons of special class, constructed to carry exception loads, they favour the adoption of high capacity wagons where the traffic warrants."

An interesting chapter is devoted to the needs and possibilities of commercial air transport, whilst some illuminating statistics are given as to the increased use being made of this arm of transport. It is the author's view that the main need in Great Britain at the moment is the introduction of municipal or civil air stations in or adjacent to all large towns. This would lead, by the innovation of regular air services, to the gradual building up of passenger mail and goods transportation by air, whilst, no doubt, air taxis and special services would develop as a matter of course. The main disabilities under which aircraft at present operate, namely, small tonnage or carrying capacity and unfavourable climatic conditions, will no doubt be gradually swept away. The important question of safety is certainly not being lost sight of, and air transport, even at the present time, can be considered quite as free from accident as any other type of transportation.

On the whole, Mr. Hastie's contribution to this important subject may be regarded as a balanced and comprehensive survey of all the factors. His information is presented with a wealth of illuminating detail which gives evidence of a richly stored mind and an enthusiastic interest in his chosen profession. The book is highly recommended and is likely to be regarded as a standard work upon transport.

Correspondence.

Correspondents should forward their communications as early as possible. *No letter can be published unless we have the writer's name and address in our possession.*

High-resistance Cable Faults.

The article by Mr. T. G. Partridge which appeared in the issue of the Electrical Review of August 22nd, 1930, brings back to my mind a suggestion I made to one of my superiors about five or six years ago, in return for which I received a quiet smile.

I suggested that the clamping glands for the cables should be insulated from the metal joint box, instead of being in metallic contact as at present, and that the bonding should be carried out by means of a heavy copper bond only with a lug connection to the metal joint box.

In the event of an earth fault the copper bond could be cut, if other means were not provided for its disconnection, such as lugs bolted together, thereby breaking continuity of lead sheathings. By testing in a similar manner to that mentioned by the author the direction of the fault could be located. Also, by undoing the lug connection to the box, it would be possible to determine if the fault was inside the box.

The suggestion in my opinion is most applicable to the type of joint box manufactured by Callender's Cable & Construction Co. at that time, the only alteration being to the outside cast-iron collar which grips the gland. It would require to be made of an insulating material and could be inserted into the casting in the same manner as the top portion of the collar.

By adopting this construction it would be possible to locate breakdowns quickly, and carry out periodic tests as suggested by the author of the aforementioned article.

Opinions of my suggestion would be much appreciated.

Mainsman.

October 6th, 1930.

A Small-motor Problem.

I would like to reply to "H. Bush," whose query appeared in the "Correspondence" columns of your issue of the 3rd inst.

Apparently the machine is one with a fixed brush position, therefore requiring care in connecting the armature-coil ends to the proper commutator segments. If these are brought out at the wrong angle, the effect is to give the brushes a forward (or backward) lead.

This forward lead will very often cause quite a long arc to form in front of the brushes, when being run on a.c., but on d.c. the speed is affected and the motor would in all probability overheat.

Your correspondent does not state at what angle the arc is with the brushes. Assuming something between 120 deg. and 180 deg., it would be accounted for by the over saturated field "fringing."

S. F. Blunden.

Enfield, *October 4th*, 1930.

Replying to your correspondent's query under the above heading in your issue of October 3rd, the arcing is possibly due to the armature leads not being brought out to the correct position on the commutator. If this is the case it is not possible, with fixed brush gear, to get the coils under commutation, in the "neutral" zone. There are several other factors which give rise to excessive arcing, particulars of which I will forward to Mr. Bush if he has not already cured his trouble.

C. A. Besley.

Cardiff, *October 4th*, 1930.

Electricity for the Home.

I should like to express my appreciation of the comments made by your readers in reply to the article on "My Lady's Pleasure." The mere interest it has awakened is, in itself, almost a source of satisfaction, quite apart from the many useful hints that have come to light.

In giving my own particular views on the subject my aim was by no means to harm the electrical trade as Mr. S. C. Hurry seems to suggest, all my endeavour being to "spread the gospel" of electrical devices for the home. I feel that criticism of this nature should be of definite use and in that spirit the article was written.

E.M.H.

October 4th, 1930.

Plumber-jointers and Live Work.

The letter in your issue of September 26th last bearing on the above subject was not untimely, particularly in view of the fact that so many mishaps have been made public of recent date involving loss of life and injury to limb. Were it possible to trace the history of some of those unfortunate men who have been killed or maimed, how many cases could be laid at the door of inefficiency? These are in part due to ignorance of the workmen themselves, and in part to gross negligence and inefficiency of those placed in charge of various operations carried out in dangerous situations. It is a fact, as "Biff" says, that if an engineer details a man to do a job that has an element of risk about it he goes to it like a lamb to the slaughter, due again to lack of knowledge. For there can be no denial of the fact that knowledge precedes all intelligent action. The practice of jointers working on live mains with no mate in sight is a practice that must be put a stop to. It is generally carried out with a view to trying to go one better than another workman, the mate opening up another joint hole hundreds of yards away. A skilled craftsman would not tolerate a procedure such as the foregoing, being usually familiar with and appreciating the risk attached to his work, and the need for a first-class job. That predominating pride of a craftsman is, sad to say, seldom met with in these days, and is seldom appreciated. Of course we must not lose sight of a concrete fact, and that is, the class of workman employed is generally a reflex of the knowledge and capabilities of those put in charge, apart from that policy of cutting scrag ends to save bones.

"Biff" refers to the necessity for the instruction of jointers and mates in artificial respiration. Why jointers and mates alone? Why not train every workman who has dealings with electrical apparatus about a station or network? Engineers, of course, ought also to become familiar with the treatment of cases of apparent death from electric shock. "Biff" also states that the Electrical Review notices covering procedure in case of death from electric shock are prominently displayed adjacent to electrical apparatus without exception, but, as he states, they are seldom read, let alone understood by many, in such a way that in an emergency they could be put into practice. True, lives have been saved by individuals who have taken the very clear instructions to mind. But would not practical demonstration, say for half-an-hour every week, be more effective? Now, Mr. Editors, could not your valuable paper put out a pocket number of these suggestions, also with an addition of extracts from B.O.T. or Home Office rules relative to working on live apparatus and precautions to be taken for safeguard. I am sure this could be sold at quite a nominal figure, and be the means of saving someone from the untimely darkness of death.

Cairngorm.

October 4th, 1930.

Barking Plant Extension.

In the financial columns of the *Sunday Express* of September 28th a reference was made to the extension of 150,000 kW of plant at my company's power house at Barking. In the paragraph in question the following statement appeared: "The order will certainly stay in this country and is likely to be placed on the North-East Coast."

In view of the fact that the advertisement for tenders for the plant in question appeared in your columns, I beg to attach a copy of letter which has been sent to the editor of the *Sunday Express*, which speaks for itself, and shall be grateful for the hospitality of your columns for making public the true facts of the case.

John C. Dalton,

Manager and Secretary,

County of London Electric Supply, Ltd.

London, E.C.2, *October 2nd*, 1930.

[Copy.]

The Editor,

The *Sunday Express*,

8, Shoe Lane, E.C.4.

Dear Sir,

The attention of my board of directors has been drawn to a paragraph which appeared in the financial columns of your issue of the 28th September.

The paragraph refers to the extension of 150,000 kilowatts of plant at my company's power house at Barking, and states that "The order will certainly stay in this country and is likely to be placed on the North-East Coast."

I am instructed to state that my board, having laid down emphatically the policy that the order will be placed only with the firm that submits the tender most suitable to my company's requirements, deeply resent the implication that any decision as to where such an order will be placed, has been made or yet considered .

In addition, the paragraph is most damaging to my company's interests. The paragraph may influence manufacturers to refrain from tendering, feeling, as they may, that the placing of the order is a foregone conclusion. I am to reiterate most strongly that there is no substantiation for the statement, and have to call upon you to publish this letter as soon as possible in order to mitigate any damage which may have resulted from the false statement.

(Sgd.) John C. Dalton,

Manager and Secretary.

October 2nd, 1930.

Fuel Economy.

I read your comments on "Fuel Economy" in the current issue of the ELECTRICAL REVIEW with interest.

As a power-station engineer who has had a thorough technical training in the manufacture, use, and maintenance of boiler plant, and seen the present development stage arrive, I would suggest that discussion of the next phase in development might lead to more fruitful results than dealing with the pros and cons of the two existing types.

This appears to me to be the introduction of gas-firing for boilers (admittedly not original) and the ultimate use of a source of energy other than coal.

The flexibility of the large-sized modern boiler plant is only what one would expect; similarly the question of fuel mixing, with the qualities of coal now used, has become of little importance, if it ever had much in a well run boiler house.

What a field yet remains for the generation and utilisation of electrical power is only too well shown by the annual coal output of the mines in this country, amounting to some 200,000,000 tons, of which the electrical power stations use only 7,000,000 tons, 40 and 70 million tons being used for domestic and manufacturing purposes, respectively.

E. A. Hilton.

Manchester, *October 3rd*, 1930.

[The actual figures relating to coal used were given in our issue of September 12th, 1930.—EDS. ELEC. REV.]

Published Specifications.

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specification will be printed and abridged, and all subsequent proceedings will be taken.

1929.

6,858. "Electric resonant units." British Thomson-Houston Co., Ltd. March 2nd, 1928. (307,081.)

7,623. "Combined electrotherapeutic apparatus and sign." J. R. Quain. March 8th, 1929. (Cognate application, 12,179/29.) (334,903.)

7,852. "Electrical apparatus and systems for controlling electric current generators." Eclipse Machine Co. March 13th, 1928. (307,796.)

10,853. "Method of interrupting an alternating-current electric circuit." Conduit Electrical Manufacturing Corporation. November 30th, 1928. (334,834.)

11,226. "Thermionic valve amplifying systems." British Thomson-Houston Co., Ltd. April 11th, 1928. (309,508.)

13,979. "High-frequency thermionic valve amplifier." M. Von Ardenne. May 5th, 1928. (310,979.)

14,381. "High-tension switches." Siemens-Schuckertwerke Akt. Ges. May 23rd, 1928. (312,269.)

14,539. "Automatic telephone systems." E. Zoller and J. Villiger. May 9th, 1929. (334,839.)

14,566. "Electron-discharge tubes." Siemens-Schuckertwerke Ges. May 12th, 1928. (Addition to 253,505.) (311,413.)

14,572. "Manufacture of electric cables." W. S. Smith, H. J. Garnett, and J. N. Dean. May 9th, 1929. (334,840.)

14,719. "High-tension electric cable with hollow conductor." J. Hanausko. May 11th, 1928. (311,422.)

14,722. "Wireless signalling system." Hazeltine Corporation. May 25th, 1928. (312,354.)

14,820. "Thermionic valves." Dr. B. Loewe. May 12th, 1928. (311,654.)

14,831. "Signalling apparatus for use in connection with marine and aerial navigation." C. A. Stevenson and D. A. Stevenson. June 13th, 1929. (334,927.)

14,880. "Road traffic signalling apparatus." A. Reyrolle & Co., Ltd., F. M. Linstow, and H. Wright. May 13th, 1929. (334,928.)

15,247. "Loaded electric signalling conductors." Electrical Research Products, Inc. June 6th, 1928. (313,077.)

16,598. "High-frequency choking coils." W. L. Shaw and Radio Instruments, Ltd. May 29th, 1929. (334,852.)

17,126. "Electric discharge devices." Telefunken Ges. für Drahtlose Telegraphie. June 25th, 1928. (314,332.)

17,354. "Electric lampholders." R. I. Kinnear. June 6th, 1929. (334,859.)

17,555. "Wireless receiving apparatus." H. Sylvester. June 7th, 1929. (334,861.)

17,677. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd., C. E. Beale, and H. S. Deyes. June 8th, 1929. (334,845.)

17,706. "Electric arc carbons or electrodes." Compagnie Lorraine de Charbons pour l'Electrique. July 23rd. 1928. (316,130.)

17,729. "Holders for thermionic valves and like devices." Benjamin Electric, Ltd., and G. Campbell. June 10th, 1929. (334,865.)

17,809. "Electric incandescent lamps." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. July 27th, 1928. (316,292.)

17,821. "Transmission volume control systems for electric signalling." Electrical Research Products, Inc. December 17th, 1928. (334,869.)

17,826. "Electrical circuits for the amplification of electrical impulses." J. I. Smith and A. E. Clarke. June 10th, 1929. (334,895.)

17,865. "Electric fuses." J. Schu. June 11th, 1929 (334,896.)

17,867. "Vacuum electric tube devices." Westinghouse Lamp Co. June 11th, 1928. (313,447.)

17,950. "Electrical signal or speech transmission systems." Electrical Research Products, Inc. December 29th, 1928. (334,899.)

17,994. "Electric tumbler switches." Wandsworth Electrical Manufacturing Co., Ltd., A. Reynolds, and T. Batchelor. June 12th, 1929. (Cognate application, 4,305/30.) (334,934.)

18,067. "Electric oscillation generators." British Thomson-Houston Co., Ltd. June 12th, 1928. (313,502.)

18,068. "Electric circuit interrupters." British Thomson-Houston Co., Ltd. June 14th, 1928. (313,563.)

18,158. "Electromagnetic relays." Electrical Research Products, Inc. June 23rd, 1928. (Addition to 274,815.) (314,069.)

18,199. "Switchgear." Crompton Parkinson, Ltd., and G. Page. June 13th, 1929. (334,943.)

18,270. "Adapters and like electrical fittings." W. S. Smith, C. V. H. Garnett, and A. Parsons. June 13th, 1929. (334,947.)

18,277. "Regulating means for regulating transformers." Siemens-Schuckertwerke Akt. Ges. June 14th, 1928. (313,572.)

18,352. "Mercury or the like switches." British Thomson-Houston Co., Ltd., and G. G. Garton. June 14th, 1929. (Addition to 310,585.) (334,949.)

18,409. "Synchronous alternating-current dynamo-electric machines." N. Japolsky. June 14th, 1929. (334,953.)

18,689. "Simultaneous transmission of pictures and sound." Telehor Akt. Ges. March 22nd, 1929. (334,967.)

18,840. "Oil-filled cables." General Cable Corporation. June 19th, 1928. (313,928.)

18,887. "Coupling systems for thermionic radio-frequency amplifiers." Hazeltine Corporation. June 14th, 1928. (Addition to 273,639.) (315,399.)

19,137. "Electric motor-control systems." A. J. Hall, H. K. Ramsden, and Associated Electrical Industries, Ltd. June 21st, 1929. (334,973.)

19,140. "Radio direction finding." C. Lorenz Akt. Ges. July 19th, 1928. (315,830.)

19,654. "Radio directional receiving systems." Marconi's Wireless Telegraph Co., Ltd. March 5th, 1929. (334,977.)

19,712. "Wireless units." M. E. Hampshire and H. Garton. June 26th, 1929. (334,978.)

19,739. "Electric remote-control systems." British Thomson-Houston Co., Ltd. June 27th, 1928. (314,442.)

20,031. "Electric switches." A. E. White (Cheney Bros.). June 29th, 1929. (334,983.)

20,463. "Electric couplings." F. J. Hopper. July 3rd, 1929. (334,985.)

20,706. "Electric coupling elements." General Electric Co., Ltd. July 5th, 1929. (334,989.)

20,803. "Electrolytic apparatus." A. E. Knowles. July 6th, 1929. (334,991.)

21,374. "Electric motor-control ssytems." British Thomson-Houston Co., Ltd., and W. B. Green. July 11th, 1929. (334,994.)

21,534. "Direction finders incorporating electron devices." Berryman Electric Co., Inc. December 5th, 1928. (334,995.)

21,647. "Tuning systems for wireless receivers." Gramophone Co., Ltd., and C. E. G. Bailey. July 13th, 1929. (334,996.)

21,774. "Electric discharge tubes." S. G. S. Dicker (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). July 15th, 1929. (334,998.)

22,491. "Radio signalling systems." Telefunken Ges. für Drahtlose Telegraphie. July 20th, 1928. (316,101.)

23,555. "Electric contact actuating mechanism for use in conjunction with time disks or wheels." Landis & Gyr Soc. Anon. August 23rd, 1928. (317,821.)

23,667. "Thermionic valve circuits." Telefonaktiebolaget L. M. Ericsson. October 1st, 1928. (335,009.)

22,668. "Duplex telegraphy." Siemens & Halske Akt. Ges. August 2nd, 1928. (316,677.)

23,704. "Aerial systems for transmitting and receiving wireless signals." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. September 19th, 1928. (319,267.)

24,850. "Vacuum tubes for producing Röntgen rays." Siemens-Reiniger-Veifa Ges. für Medizinische Technik. October 26th, 1928. (335,021.)

25,164. "Electric discharge tubes." Egyesult Izzolampa es Villa Mossagi Reszvenytarsasag. September 17th, 1928. (319,206.)

25,294. "Electric dimmer switches and switchboards." W. Row. August 19th, 1929. (335,025.)

25,782. "Photo-electric cell." Arturus Radio Tube Co. August 24th, 1928. (317,862.)

26,088. "Terminal blocks or connections." Belling & Lee, Ltd., and E. M. Lee. August 27th, 1929. (335,033.)

26,175. "Electric signalling systems, particularly telephone systems." Siemens Bros. & Co., Ltd., and A. T. C. Moore. August 28th, 1929. (335,035.)

26,667. "Supporting arms for electrical pick-ups." Limit Engineering Co., Ltd., and N. Collins. September 2nd, 1929. (335,040.)

27,086. "Microphones and like instruments." Ges. für Elektrische Apparate. September 7th, 1928. (318,634.)

27,137. "Intercommunications between telephone systems." Siemens Bros. and Co., Ltd., and W. H. Grinsted. September 6th, 1929. (335,046.)

27,866. "Pneumatically-operated electric switches." International General Electric Co., Inc. September 19th, 1928. (319,277.)

29,339. "Means for amplifying electrical impulses." British Thomson-Houston Co., Ltd. October 17th, 1928. (335,068.)

29,360. "Production of picture-scanning and reconstituting disks of television and picture-transmitting apparatus." D. Von Mihaly. September 27th, 1929. (335,069.)

30,650. "Electric condensers." Marconi's Wireless Telegraph Co., Ltd. October 10th, 1928. (335,083.)

31,161. "Switch fuses for electric vehicles running on rails." J. C. Buchholz. October 14th, 1929. (335,085.)

32,789. "Electrically-driven hair-cutting machines." R. Bosch Akt. Ges. November 7th, 1928. (Addition to 306,028.) (335,096.)

34,296. "Telephone system on pupinised cables, particularly with light loading." Siemens & Halske Akt. Ges. November 10th, 1928. (Addition to 291,110.) (335,108.)

34,842. "Apparatus for guiding and protecting electric cables." H. Muller. November 15th, 1928. (335,113.)

35,697. "Railway signalling arrangements." Associated Telephone and Telegraph Co. May 5th, 1928. (Divided application on 14,124/29.) (334,901.)

36,248. "Wireless direction-finding apparatus." Telefunken Ges. für Drahtlose Telegraphie. January 16th, 1929. (335,118.)

38,028. "Electric condensers." British Thomson-Houston Co., Ltd. December 18th, 1928. (335,129.)

1930.

221. "Electric heaters." P. Halasz. January 2nd, 1930. (335,136.)

1,412. "Multi-core electric cables." W. Brown. January 15th, 1930. (335,141.)

3,380. "Electric condensers." Elektricitäts Akt. Ges. Hydrawerk. February 1st, 1929. (Addition to 306,100.) (335,144.)

8,155. "Protecting sheaths for electric wires." J. Escol. March 27th, 1929. (335,147.)

8,579 "Oil-pressure compensating devices for oil-filled electric cables." Siemens-Schuckertwerke Akt. Ges. March 18th, 1929. (335,148.)

18,836. "Electric selective remote indicating and metering systems." A. Reyrolle & Co., Ltd., B. H. Leeson, W. Anderson, and D. E. Lambert. June 1st, 1929. (Divided application on 16,918/29.) (334,846.)

Trade Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from October 1st, 1930 :—

Supervac. No. 514,214. Class 6. Vacuum cleaning machines.—John Shaw and Sons, Wolverhampton, Ltd., Fryer Street, Wolverhampton.

Busy Bee. No. 513,239. Class 6. Electric refrigerating machines.—Drake and Gorham Wholesale, Ltd., 77, Long Acre, W.C.2.

B.R.C.; The British Radio Corporation, Ltd.; Buy British Goods (lettering and design). No. 501,303. Class 8. Radio-telephonic receiving sets.—British Radio Corporation, Ltd., 14-15, New Burlington Place, W.1.

Cutax. No. 510,625. Class 8. Time and automatic switches, mercury interruptors and switches, &c., all being electrical goods.—Dr. Paul Meyer Gesellschaft, Berlin. (British representatives: Gill, Jenning & Every-Clayton, 51-52, Chancery Lane, W.C.2.)

LLL. (lettering and design). No. 512,183. Class 8. Instruments for engineering and electrical measurements, wireless receiving sets, &c.—Lanchester's Laboratories, Ltd., Spring Road, Tyseley, Birmingham.

Noxum. No. 514,962. Class 8. Philosophical and scientific instruments and apparatus for useful purposes.—Lissen, Ltd., Isleworth, Middlesex.

Boynton's Radio Battery with Nine Lives (lettering and design). No. 515,264. Class 8. High-tension batteries (not for medical purposes).—Boynton and Co., Ltd., 73, Stafford Street, Birmingham.

His Master's Voice (lettering and design). No. 515,670. Class 8. Thermionic valves.—Gramophone Co., Ltd., Hayes, Middlesex.

New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

BEXHILL-ON-SEA.—Houses (222) for the T.C.; borough surveyor. Post office for H.M. Office of Works, King Charles Street, London, S.W. Houses, Southlands Road; E. Bruce, Sea Road. Houses, Dalmeny Road, Watermill Lane, and Gunters Lane, and additions to Seafield School, Collington Lane; J. E. Maynard, architect.

BIRKENHEAD.—Omnibus garage, New Ferry; borough engineer.

BOLTON.—Junior school, Tonge Moor, for the E.C.

BRIGG.—Houses (62); R.D.C. surveyor.

BRIGHTON.—Rebuilding business stores, London Road, for the London & County Furnishing Co., Ltd.

BRISTOL.—Extensions to docks (£29,000); city engineer.

BURY (Lancs.).—Catholic church, Woolfold; John Tinline, Ltd., builders. Town hall extensions for the T.C.; J. Chadwick, borough engineer.

CHELMSFORD.—New wards, Chelmsford and Essex Hospital; governors. Showrooms, London Road; Eastern Automobiles, Ltd.

CHESTERFIELD.—Re-erection of napthaline distillation works, electrically equipped, for Clay Cross Coal and Iron Co., Ltd.

CHURCH STRETTON. — Primitive Methodist Church, Lebotwood; trustees.

COVENTRY.—Wesleyan central hall (£29,150); H. Clarke and Sons, builders.

CROWBOROUGH.—Cinema; H. W. Cousens, architect.

CROYDON.—Houses (162) for the T.C.; borough surveyor. Library, Norbury (£16,000) for the T.C.; Elliman and Son, Ltd., builders, Beckenham. School, Shirley, and extensions, Thornton Heath Polytechnic, for the borough E.C.; director of education. Elementary school, Kensington Street; A. Sunderland, architect. Extensions for Grant Bros., Ltd. Head offices for Hall & Co., Ltd., with lighting and heating work; Wallis, Gilbert and Partners, architects, 29, Roland Gardens, S.W.

DERBY.—Town hall and municipal buildings for the T.C.; H. V. Lanchester, architect.

DERBYSHIRE.—Extensions, Glossop Grammar School, for the E.C.; G. H. Widdows, county architect, St. Mary's Gate, Derby.

DORSET.—Grammar school, Lyme Regis, for the E.C.; Broad and Dockerill, Lansdowne, Bournemouth.

DURSLEY.—Houses (50) for the R.D.C.; Capt. C. W. Yates, architect.

EDINBURGH.—Conversion of Seafield Institution into hospital (£21,000); E. J. Macrae, city architect.

GLASGOW.—Schools, Parkhouse (£30,000), and extensions to St. Mark's, Kilmany Street, for the E.C. Home for 300 aged poor; Public Assistance Committee.

GLOUCESTER.—Houses (120), Coney Hill, for the T.C.; city surveyor.

GUILDFORD.—Development, Pewley Hill estate; Poyle Charity Trustees. Ice factory, Walnut Tree Close; Colebrook & Co. Central stores, Haydon Place; Guildford Co-op. Society, Ltd. Technical college for the Surrey E.C.; education architect, Kingston-on-Thames.

HAMILTON.—Workshops for Lanarkshire Bolt and Rivet Co., Ltd., Greenfield Road, Burnbank; A. W. Weir, manager.

HEMSWORTH.—Houses (200), Upton; R.D.C. surveyor.

HIGH WYCOMBE.—Factory, Suffield Road, for W. Davis, Ltd.

IRISH FREE STATE (Fermoy, Co. Cork).—Technical school; John Browne, 6, Parnell Terrace.

LEEDS.—Flats, Torre housing estate; city architect.

LEICESTER.—Houses (88) Braunstone estate (£36,227); Bodill & Sons. Houses, Saffron Hill area (£16,136) and Tailby estate (£24,564); Harris Bros. (Derby), Ltd. Estate development off Evington Valley Road; Horace Frearson. Extensions to museum (£11,332); W. M. Sharp & Son, Ltd. Schools, Abbey Park Road and Knighton Lane, for the E.C.

LIVERPOOL.—Blocks of tenements, Garston and South Hill Road; land steward and surveyor, Municipal Buildings, Dale Street.

LONDON (East Ham, E.).—Houses (126), Charlmont Road (£95,987); Corolite Construction Co., Ltd. Houses, Lawrence Avenue; Church Army Housing, Ltd. Abattoir; borough engineer.

(Ilford, E.).—Elementary school, Aldborough Avenue, for the E.C. Town hall extension (£62,000); borough engineer.

(Kensington, W.).—School (600 places); L.C.C. architect.

MACCLESFIELD (Staffs.).—Branch premises for the Macclesfield Co-operative Society, Ltd. (£16,000); Gorton and Wilson, builders, Elizabeth Street.

MANCHESTER.—Houses (36), Newton Heath (£18,000); city architect. School (200 places), Victoria Avenue, Blackley; St. Clare's R.C. Trustees. Extensions to clinics, Cannel Street and Moston Lane; E. Marshall and Sons, Ltd. Garage, Water Street cleansing depôt; city architect, Town Hall.

NORTHAMPTON.—Extensions, Town and County School, including art room and laboratory, for the borough E.C.; director of education.

NUNEATON.—Houses (200) for the T.C.; borough surveyor.

RENFREWSHIRE.—Employment exchange, Barrhead, architect, H.M. Office of Works, 122, George Street, Edinburgh.

ROTHERHAM.—School (£17,000) for the borough E.C.; director of education.

RUSHDEN.—Works extensions, Impregnable Boot Co.

SALFORD.—Reconstruction of baths at Blackfriars Road (£56,000), and Clarence Street, Broughton (£24,000); also conveniences in parks (£19,000); borough engineer. Extensions, Royal Technical College and Pendleton High School for Girls, for the borough E.C.; borough surveyor.

SHIPLEY.—Houses (42), Wrose Road; A. & F. Mellor. Additions, St. Walburga's School, Fairfield Road; trustees. Shops, off Leeds Road; Windhill Co-op. Society, Ltd.

SLEAFORD.—Post office, Southgate, for H.M. Office of Works, King Charles Street, London, S.W.

SLOUGH.—Refuse destructor for the U.D.C.; surveyor.

SMETHWICK.—Houses (1,612). Warley estate; borough engineer. Stores, Halfords Lane; Henry Pope and Sons, Ltd.

SOWERBY BRIDGE.—Employment exchange, Allan Park, for H.M. Office of Works, King Charles Street, London, S.W.

THORNTON (near Fleetwood).—Senior school; E. Taylor and Co., builders, Littleborough.

WESTERHAM (Kent).—Improvements, Biggin Hill aerodrome, for the Air Ministry.

WESTON-SUPER-MARE.—Business stores, High Street, for Timothy White's (1928), Ltd., Chandos Street, Portsmouth.

WEST RIDING.—School, Hebden Bridge, for the county E.C.; director of education, Wakefield.

YORK.—Houses (100), Tang Hall Lane; H. Williamson. Garage extensions, Barbican Road; West Yorks Road Car Co.